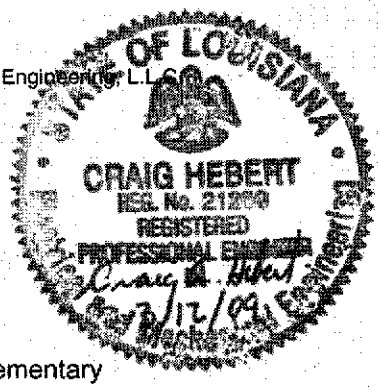


SECTION 16050 -BASIC ELECTRICAL MATERIALS AND METHODS

PART 1- GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following electrical materials and methods:

1. Building wire, connectors, and splices for branch circuits and feeders.
2. Supporting devices for electrical components.
3. Concrete equipment bases.
4. Electrical identification.
5. Cutting and patching for electrical construction.
6. Touchup painting.

B. Where a "Standard Specification" (i.e., ANSI, UL, etc.) is referenced and no manufacturer's are listed, the Contractor shall submit for Prior Approval in adherence with the specified Standard, and in accordance with the submittal requirements identified.

1.3 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

1.4 QUALITY ASSURANCE

A. Comply with NFPA 70 for components and installation.

B. Listing and Labeling: Provide products specified in this Section that are listed and labeled.

1. The Terms "Listed and Labeled": As defined in the National Electrical Code, Article 100.
2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

1.5 SEQUENCING AND SCHEDULING

A. Coordinate electrical equipment installation with other building components.

B. Arrange for chases, slots, and openings in building structure during progress of construction to allow for electrical installations.

C. Coordinate installing required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

D. Sequence, coordinate, and integrate installing electrical materials and equipment for efficient flow of the Work. Coordinate installing large equipment requiring positioning prior to closing in the building.

E. Coordinate connecting electrical service to components furnished under other Sections.

F. Coordinate connecting electrical systems with exterior underground and overhead utilities and

services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies.

G. Coordinate installing electrical identification after completion of finishing where identification is applied to field-finished surfaces.

PART 2 - PRODUCTS

2.1 BUILDING WIRE

A. Description: Single conductor, copper. Solid conductor for No. 10 AWG and smaller; stranded conductor for larger than No. 10 AWG.

B. Cross-Linked Polyethylene Insulated Wire: Conform to NEMA WC7. Provide factory-fabricated wire of sizes, ampacity ratings, and materials for applications and services indicated. Where not indicated, provide proper selection as determined by Installer to comply with project's installation requirements, NEC and NEMA standards. Select from the following UL types, those wires with construction features which fulfill project requirements:

1. Type THWN:For dry and wet locations; max operating temperature 75 deg C (167 deg F). Insulation, flame-retardant, moisture- and heat-resistant, thermoplastic; outer covering, nylon jacket; conductor, annealed copper.
2. Type THHN:For dry and damp locations; max operating temperature 90 deg C (194 deg F). Insulation, heat-resistant thermoplastic flame-retardant, nylon jacket; conductor, annealed copper.

A. Connectors and Splices: Units of size, ampacity rating, material, type, and class suitable for service indicated. Select to comply with Project's installation requirements.

2.2 SUPPORTING DEVICES

A. Channel and angle support systems, hangers, anchors, sleeves, brackets, fabricated items, and fasteners are designed to provide secure support from the building structure for electrical components.

1. Material: Steel, except as otherwise indicated, protected from corrosion with zinc coating or with treatment of equivalent corrosion resistance using approved alternative finish or inherent material characteristics.
2. Metal Items for Use Outdoors or in Damp Locations: Hot-dip galvanized steel, except as otherwise indicated. Provide NEMA 3R Housing for devices installed outdoors.

B. Steel channel supports have 9/16-inch diameter holes at a maximum of 8 inches o.c., in at least 1 surface.

1. Fittings and accessories mate and match with channels and are from the same manufacturer.

A. Raceway and Cable Supports: Manufactured clevis hangers, riser clamps, straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring steel clamps or "click"-type hangers.

B. Sheet-Metal Sleeves: 0.0276-inch or heavier galvanized sheet steel, round tube, closed with welded longitudinal joint.

C. Expansion Anchors: Carbon-steel wedge or sleeve type.

A. Toggle Bolts: All-steel springhead type.

B. Powder-Driven Threaded Studs: Heat-treated steel.

2.3 CONCRETE EQUIPMENT BASES

A. Concrete: 3000-psi, 28-day compressive strength.

2.4 ELECTRICAL IDENTIFICATION

A. Manufacturer's Standard Products: Where more than one type is listed for a specified application, selection is Installer's option, but provide single type for each application category. Use colors prescribed by ANSI A13.1, NFPA 70, and these Specifications.

B. Colored Adhesive Marking Tape for Raceways, Wires, and Cables: Self-adhesive vinyl tape not less than 3 mils thick by 1 inch wide.

C. Tape Markers: Vinyl or vinyl-cloth, self-adhesive, wraparound type with preprinted numbers and letters.

D. Engraved, Plastic-Laminated Labels, Signs, and Instruction Plates: Engraving stock, melamine plastic laminate punched for mechanical fasteners 1/16-inch minimum thick for signs up to 20 sq. in., 1/8 inch thick for larger sizes. Engraved legend in black letters on white face. Provide engraved laminate plate with white letters on a red face for emergency power panels.

E. Fasteners for Plastic-Laminated and Metal Signs: Self-tapping stainless-steel screws or No. 10/32 stainless-steel machine screws with nuts and flat and lock washers.

2.5 TOUCHUP PAINT

A. For Equipment: Provided by equipment manufacturer and selected to match equipment finish.

B. For Galvanized Surfaces: Zinc-rich paint recommended by item manufacturer.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION REQUIREMENTS

A. Install components and equipment to provide the maximum possible headroom where mounting heights or other location criteria are not indicated.

B. Install items level, plumb, and parallel and perpendicular to other building systems and components, except where otherwise indicated.

C. Install equipment to facilitate service, maintenance, and repair or replacement of components. Connect for ease of disconnecting, with minimum interference with other installations.

D. Give right of way to raceways and piping systems installed at a required slope.

3.2 WIRING METHODS

A. Feeders: Type THHN/THWN/XHHW, copper conductor in raceway.

B. Underground Feeders: Type THHN/THWN/XHHW, copper conductor, in raceway.

C. Branch Circuits: Type THHN/THWN/XHHW, in raceway.

3.3 ELECTRICAL SUPPORTING METHODS

A. Damp Locations and Outdoors: Hot-dip galvanized materials, U-channel system components.

B. Dry Locations: Steel materials.

C. Conform to manufacturer's recommendations for selecting supports.

D. Strength of Supports: Adequate to carry all present and future loads, times a safety factor of at least 4; 200-lb minimum design load.

3.4 INSTALLATION

A. Install wires in raceway according to manufacturer's written instructions and NECA's "Standard of Installation."

B. Conductor Splices: Keep to the minimum and comply with the following:
   1. Install splices and taps that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
   2. Use splice and tap connectors that are compatible with conductor material.
   3. Splices shall be installed with adequate access for Testing and Maintenance.

C. Wiring at Outlets: Install with at least 12 inches of slack conductor at each outlet.

D. Connect outlets and components to wiring systems and to ground as indicated and instructed by manufacturer. Tighten connectors and terminals, including screws and bolts, according to equipment manufacturer's published torque-tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals according to tightening requirements specified in UL 486A.

E. Install devices to securely and permanently fasten and support electrical components.

F. Raceway Supports: Comply with NFPA 70 and the following requirements:

   1. Conform to manufacturer's recommendations for selecting and installing supports.
   2. Install individual and multiple raceway hangers and riser clamps to support raceways. Provide U bolts, clamps, attachments, and other hardware necessary for hanger assembly and for securing hanger rods and conduits.
   3. Support parallel runs of horizontal raceways together on trapeze- or bracket-type hangers.
   4. Spare Capacity: Size supports for multiple conduits so capacity can be increased by a 25 percent minimum in the future.
   5. Support individual horizontal raceways with separate, malleable iron pipe hangers or clamps.
   6. Hanger Rods: 1/4-inch diameter or larger threaded steel, except as otherwise indicated.
   7. Spring Steel Fasteners: Specifically designed for supporting single conduits or tubing. May be used in lieu of malleable iron hangers for 1-1/2-inch and smaller raceways serving lighting and receptacle branch circuits above suspended ceilings and for fastening raceways to channel and slotted angle supports.

A. Miscellaneous Supports: Install metal channel racks for mounting cabinets, panelboards, disconnects, control enclosures, pull boxes, junction boxes, transformers, and other devices except where components are mounted directly to structural features of adequate strength.

B. Sleeves: Install for cable and raceway penetrations of concrete slabs and walls, except where core-drilled holes are used. Install for cable and raceway penetrations of masonry and fire-rated gypsum walls and of all other fire-rated floor and wall assemblies.

C. Firestopping: Apply to cable and raceway penetrations of fire-rated floor and wall assemblies. Perform firestopping to reestablish the original fire-resistance rating of the assembly at the penetration.

D. Fastening: Unless otherwise indicated, securely fasten electrical items and their supporting hardware to the building structure. Perform fastening according to the following:

1. Fasten by means of toggle bolts on hollow masonry units; concrete inserts or expansion bolts on concrete or solid masonry; and by machine screws, welded threaded studs, or spring-tension clamps on steel.
2. Threaded studs driven by a powder charge and provided with lock washers and nuts may be used instead of expansion bolts, machine screws, or wood screws.
3. In partitions of light steel construction use sheet-metal screws.
4. Drill holes in concrete so holes more than 3/4 inch deep do not cut main reinforcing bars.
5. Fill and seal holes drilled in concrete and not used.
6. Select fasteners so the load applied to any fastener does not exceed 25 percent of the proof-test load.

A. Install identification devices where required.

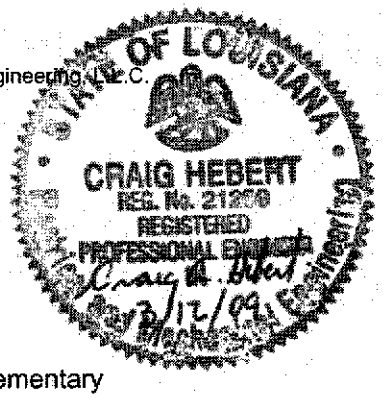
1. Install labels where indicated and at locations for best convenience of viewing without interference with operation and maintenance of equipment.
2. Coordinate names, abbreviations, colors, and other designations used for electrical identification with corresponding designations indicated on the Contract Documents or required by codes and standards. Use consistent designations throughout the Project.
3. Self-Adhesive Identification Products: Clean surfaces of dust, loose material, and oily films before applying.
4. For panelboards, provide framed, typed circuit schedules with explicit description and identification of items controlled by each individual breaker.

3.5 CUTTING AND PATCHING

A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces necessary for electrical installations. Perform cutting by skilled mechanics of the trades involved.

B. Repair disturbed surfaces to match adjacent undisturbed surfaces.

END OF SECTION 16050



SECTION 16100 - RACEWAYS, BOXES, AND CABINETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

B. Raceways include the following:

1. Rigid metal conduit.
2. Electrical metallic tubing (EMT).
3. Flexible metal conduit.
4. Liquidtight flexible conduit.
5. Rigid nonmetallic conduit.
6. Wireway.

C. Boxes, enclosures, and cabinets include the following:

1. Device boxes.
2. Floor boxes.
3. Outlet boxes.
4. Pull and junction boxes.
5. Cabinets and hinged cover enclosures.

1.2 QUALITY ASSURANCE

A. Comply with NFPA 70 "National Electrical Code" for components and installation.

B. Listing and Labeling: Provide products specified in this Section that are listed and labeled.

1. The Terms "Listed and Labeled": As defined in the "National Electrical Code," Article 100.
2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

C. Comply with NECA "Standard of Installation."

D. Coordinate layout and installation of raceway and boxes with other construction elements to ensure adequate headroom, working clearance, and access.

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND TUBING

A. Rigid Steel Conduit: ANSI C80.1.

B. Electrical Metallic Tubing and Fittings: ANSI C80.3 with compression-type fittings.

C. Flexible Metal Conduit: Zinc-coated steel.

D. Liquidtight Flexible Metal Conduit: Flexible steel conduit with PVC jacket.

E. Fittings: NEMA FB 1, compatible with conduit/tubing materials.

2.2 NONMETALLIC CONDUIT AND TUBING

A. Rigid Nonmetallic Conduit (RNC): Schedule 40 or 80 PVC.

B. PVC Conduit and Tubing Fittings: match to conduit or conduit/tubing type and material.

2.3 WIREWAYS

A. Material: Sheet metal sized and shaped as indicated.

B. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireway as required for complete system.

C. Wireway Covers: Hinged type.

D. Finish: Manufacturer's standard enamel finish.

2.4 OUTLET AND DEVICE BOXES

A. Sheet Metal Boxes: NEMA OS 1.

B. Cast Metal Boxes: NEMA FB 1, type FD, cast feralloy box with gasketed cover.

2.5 FLOOR BOXES

A. Floor Box: Cast metal, fully adjustable, rectangular.

2.6 PULL AND JUNCTION BOXES

A. Small Sheet Metal Boxes: NEMA OS 1.

B. Cast Metal Boxes: NEMA FB 1, cast aluminum with gasketed cover.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces to receive raceways, boxes, enclosures, and cabinets for compliance with installation tolerances and other conditions affecting performance of the raceway system. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 WIRING METHODS

A. Outdoors: Use the following wiring methods:

1. Exposed: Rigid metal conduit.
2. Underground, Single Run: Rigid nonmetallic conduit.
3. Underground, Grouped: Rigid nonmetallic conduit.
4. Connection to Vibrating Equipment (including transformers and hydraulic, pneumatic, or electric solenoid or motor-driven equipment): Liquidtight flexible metal conduit.
5. Boxes and Enclosures: NEMA Type 3R or Type 4.

B. Indoors: Use the following wiring methods:

1. Connection to Vibrating Equipment (including transformers and hydraulic, pneumatic, or electric solenoid or motor-driven equipment): liquidtight flexible metal conduit.
2. Damp or Wet Locations: Rigid steel conduit.
3. Exposed: Electrical metallic tubing.
4. Concealed: Electrical metallic tubing or flexible metal conduit (FMC).
5. Boxes and Enclosures: NEMA Type 1, except in damp or wet locations use NEMA Type 3R.

3.3 INSTALLATION

A. Install raceways, boxes, enclosures, and cabinets as indicated, according to manufacturer's written instructions.

B. Conceal conduit and EMT, unless otherwise indicated, within finished walls, ceilings, and floors.

C. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot water pipes. Install horizontal raceway runs above water and steam piping.

D. Install raceways level and square and at proper elevations. Provide adequate headroom.

E. Complete raceway installation before starting conductor installation.

F. Support raceway as specified in Division 16 Section "Supporting Devices."

G. Use temporary closures to prevent foreign matter from entering raceway.

H. Protect stub-ups from damage where conduits rise through floor slabs. Arrange so curved portion of bends is not visible above the finished slab.

I. Make bends and offsets so the inside diameter is not reduced. Unless otherwise indicated, keep the legs of a bend in the same plane and the straight legs of offsets parallel.

J. Use raceway fittings compatible with raceway and suitable for use and location.

K. Run concealed raceways with a minimum of bends in the shortest practical distance considering the type of building construction and obstructions, except as otherwise indicated.

L. Raceways Embedded in Slabs: Install in middle third of the slab thickness where practical, and leave at least 1 inch (25 mm) concrete cover.

1. Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement.
2. Space raceways laterally to prevent voids in the concrete.
3. Run conduit larger than 1-inch trade size parallel to or at right angles to main reinforcement. When at right angles to reinforcement, place conduit close to slab support.
4. Transition nonmetallic tubing to rigid steel conduit, or IMC before rising above floor.

M. Install exposed raceways parallel to or at right angles to nearby surfaces or structural members, and follow the surface contours as much as practical.

1. Run parallel or banked raceways together, on common supports where practical.
2. Make bends in parallel or banked runs from same center line to make bends parallel. Use factory elbows only where they can be installed parallel; otherwise, provide field

bends for parallel raceways.

N. Join raceways with fittings designed and approved for the purpose and make joints tight.

1. Make raceway terminations tight. Use bonding bushings or wedges at connections subject to vibration. Use bonding jumpers where joints cannot be made tight.
2. Use insulating bushings to protect conductors.

O. Terminations: Where raceways are terminated with locknuts and bushings, align the raceway to enter squarely, and install the locknuts with dished part against the box. Where terminations cannot be made secure with one locknut, use two locknuts, one inside and one outside the box.

P. Where terminating in threaded hubs, screw the raceway or fitting tight into the hub so the end bears against the wire protection shoulder. Where chase nipples are used, align the raceway so the coupling is square to the box, and tighten the chase nipple so no threads are exposed.

Q. Install pull wires in empty raceways. Use No. 14 AWG zinc-coated steel or monofilament plastic line having not less than 200-lb tensile strength. Leave not less than 12 inches of slack at each end of the pull wire.

R. Flexible Connections: Use maximum of 6 feet (1830 mm) of flexible conduit for recessed and semirecessed lighting fixtures; for equipment subject to vibration, noise transmission, or movement; and for all motors. Install separate ground conductor across flexible connections.

S. Set floor boxes level and adjust to floor surface.

T. Install hinged cover enclosures and cabinets plumb. Support at each corner.

U. Provide grounding connections for raceway, boxes, and components as indicated and instructed by manufacturer. Tighten connectors and terminals, including screws and bolts, according to equipment manufacturer's published torque-tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals according to tightening torques specified in UL Standard 486A.

3.4 PROTECTION

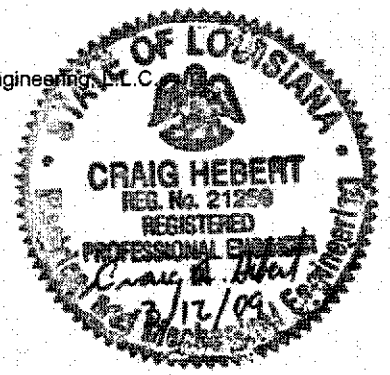
A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, to ensure that coatings, finishes, and cabinets are without damage or deterioration at Substantial Completion.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC or paint finishes with matching touch-up coating recommended by the manufacturer.

3.5 CLEANING

A. Upon completion of installation of system, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finish, including chips, scratches, and abrasions.

END OF SECTION 16100



SECTION 16140 - WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes various types of receptacles, connectors, switches, and finish plates.

B. Where a "Standard Specification" (i.e., ANSI, UL, etc.) is referenced and no manufacturer's are listed, the Contractor shall submit for Prior Approval in adherence with the specified Standard, and in accordance with Section 16050.

1.3 SUBMITTALS

A. Submit the following according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product data for each product specified.

1.4 QUALITY ASSURANCE

A. Comply with NFPA 70 "National Electrical Code" for devices and installation.

B. Listing and Labeling: Provide products that are listed and labeled for their applications and installation conditions and for the environments in which installed.

1. The Terms "Listed" and "Labeled": As defined in the "National Electrical Code," Article 100.

2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

1.5 COORDINATION

A. Wiring Devices for Owner Furnished Equipment: Match devices to plug connectors for Owner-furnished equipment.

B. Cord and Plug Sets: Match cord and plug sets to equipment requirements.

PART 2 - PRODUCTS

2.1 WIRING DEVICES

A. WEATHERPROOF RECEPTACLES

1. Weatherproof receptacles shall be duplex receptacles as specified under "WIRING DEVICES", mounted in a cast Type FD conduit box and fitting with gasketed cast metal cover with upward operating self-closing cast spring door. Weatherproof receptacles shall be flush mounted in exterior walls. Receptacles mounted on conduit supports must be rigidly supported with no openings, including screwed sealed openings at the top of the box. All boxes must have the required volume capacity for the number of conductors present. All installations must comply

with NEC 410-57 and NEC 370-6.

B. WIRING DEVICES

1. Wiring devices shall be as listed. It shall be the responsibility of the Electrical Contractor to provide plugs, receptacles and fittings required for any equipment furnished or installed or connected under the contract. Devices shall be as listed below or equal as listed by addendum. Submit for review all devices to be used.

2. Single Pole Toggle Switch: Silent actuating, 20 amp 120 volt and 277 volt:
   a. Leviton 1221 Series.
   b. Bryant 4901 Series.

2. Three Way Toggle Switch: Silent actuating, 20 amp 120 volt and 277 volt:
   a. Leviton 1223 Series.
   b. Bryant 4903 Series.

3. Receptacles: Duplex, 20 Amp, 125 volt, 3 wire, grounded frame:
   a. Leviton 5362 Series.
   b. Bryant 5362 Series.

4. Self-Contained, Ground Fault Interrupting Duplex Receptacle: 15 Amp, 125 volt, 20 Amp feed through recessed mount with matching face plate. Unless noted otherwise, all additional downstream receptacles on the same circuit as a ground fault interrupting receptacle shall be wired through and protected by the ground fault interrupting receptacle. **Do not** combine neutrals or grounds of ground fault circuits with any other circuit.
   a. Leviton 6599 Series.
   b. Bryant GFR52FT Series.

C. Color: All devices shall be gray.

D. Cord and Plug Sets: Match voltage and current ratings and number of conductors to requirements of the equipment being connected.

1. Cord: Rubber-insulated, stranded copper conductors, with type SOW-A jacket. Grounding conductor has green insulation. Ampacity is equipment rating plus 30 percent minimum.
2. Plug: Male configuration with nylon body and integral cable-clamping jaws. Match to cord and to receptacle type intended for connection.

E. Wall Plates: Single and combination types that mate and match with corresponding wiring devices. Features include the following:

1. Plate-Securing Screws: Stainless Steel.
2. Material: 0.04-inch-thick, type 302, satin-finished stainless steel.

F. Hand Dryers: Warm air, rapid drying electric hand dryer; surface mounted; entire dryer internally grounded.

1. Warranty Period: 5 years; limited warranty
2. Controls: Automatic, activated by infrared optical sensor. Operates while hands are under blower. Shut-off within 2 seconds when hands removed, or in 35 seconds if hands not removed.
3. Cover: Stainless steel with brushed finish.
4. Air Intake: Inlet openings on bottom of cover.
5. Air Outlet: Delivers focused air stream at average hand position of 4 inches (102 mm) below air outlet.

6. Noise Reduction Nozzle: 1.1 noise reduction nozzle.
7. Wall Plate: Injection molded, rib reinforced plate with metal L brackets to attach cover, with ten 5/16 inch (8 mm) diameter holes for surface mounting to wall and three 7/8 inch (22 mm) diameter holes for electrical wiring; bottom hole suitable for surface conduit.
8. Nominal Size: 11-3/4 inches wide by 12-11/16 inches high by 6-11/16 inches deep.
9. Power Source: 110/120 volt, 12.5 amp, 60 Hz
10. Combination Motor and Blower: Series commutated, through-flow discharge, vacuum type; 5/8 HP, 20,000 RPM. Air flow rate: 16,000 linear feet per minute at air outlet, 14,000 linear feet per minute at average hand position of 4 inches below air outlet.
11. Heater: Nichrome wire element, mounted inside blower housing to be vandal proof.
12. Heater Safeguard: Automatic resetting thermostat to open when air flow is restricted and close when air flow is resumed.
13. Air Temperature: 135 degrees F (55 degrees C) measured at average hand position of 4 inches below air outlet. Air Heater Output: 900 watts.
14. All metal parts coated according to Underwriters Laboratories, Inc. requirements.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install devices and assemblies plumb and secure.

B. Install wall plates when painting is complete.

C. Arrangement of Devices: Except as otherwise indicated, mount flush, with long dimension vertical, and grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

D. Protect devices and assemblies during painting.

3.2 FIELD QUALITY CONTROL

A. Testing: Test wiring devices for proper polarity and ground continuity.

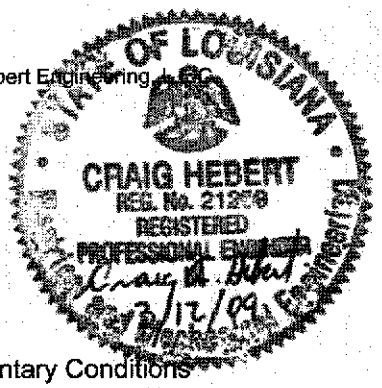
B. Test ground-fault circuit interrupter operation with both local and remote fault simulations according to manufacturer recommendations.

C. Replace damaged or defective components.

3.3 CLEANING

A. General: Internally clean devices, device outlet boxes, and enclosures. Replace stained or improperly painted wall plates or devices.

END OF SECTION 16140



SECTION 16470 - PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes lighting and power panelboards and associated auxiliary equipment rated 600 V or less.

1.3 DEFINITIONS

A. Overcurrent Protective Device (OCPD): A device operative on excessive current that causes and maintains the interruption of power in the circuit it protects.

1.4 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

B. Product data for each type panelboard, accessory item, and component specified.

C. Shop drawings from manufacturers of panelboards including dimensioned plans, sections, and elevations. Show tabulations of installed devices, major features, and voltage rating. Include the following:

1. Enclosure type with details for types other than NEMA Type 1.
2. Bus configuration and current ratings.
3. Short-circuit current rating of panelboard.
4. Features, characteristics, ratings, and factory settings of individual protective devices and auxiliary components.

1.5 QUALITY ASSURANCE

A. Listing and Labeling: Provide products specified in this Section that are listed and labeled.

1. The terms "listed" and "labeled" shall be defined as they are in the National Electrical Code, Article 100.
2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

B. Electrical Component Standard: Components and installation shall comply with NFPA 70, "National Electrical Code."

C. NEMA Standard: Comply with NEMA PB1, "Panelboards."

D. UL Standards: Comply with UL 61, "Panelboards," and UL 50, "Cabinets and Boxes."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Refer to the performance specifications outlined in this section to provide products by the following:

1. Square D Co.
2. General Electric, Inc.
3. Cutler Hammer, Inc.

2.2 PANELBOARDS, GENERAL REQUIREMENTS

A. Overcurrent Protective Devices (OCPDs): Provide type, rating, and features as indicated. Tandem circuit breakers shall not be used. Multipole breakers shall have common trip. Provide AIC ratings as shown on drawings.

B. Enclosures: Cabinets, door in door fronts, flush or surface mounted as indicted. NEMA Type 1 enclosure, except where the following enclosure requirements are indicated.
1. NEMA 3R: Raintight.

C. Front: Door in door construction. Front for surface-mounted panels shall be same dimensions as box. Fronts for flush panels shall overlap box except as otherwise specified.

D. Directory Frame: Metal, mounted inside each panel door.

E. Bus: Hard drawn copper of 98 percent conductivity.

F. Main and Neutral Lugs: Compression type. Bus shall be sized to meet the minimum A/C rating as indicated.

G. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment ground conductors. Bonded to box.

H. Provision for Future Devices: Equip with mounting brackets, bus connections, and necessary appurtenances, for the OCPD ampere ratings indicated for future installation of devices.

I. Feed-Through Lugs: Sized to accommodate feeders and A/C ratings as indicated.

2.3 LIGHTING AND APPLIANCE BRANCH CIRCUIT PANELBOARDS

A. Branch OCPDs: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

B. Double-Width Panels: Where more than 42 poles are indicated or where otherwise indicated, provide two panelboards of equal height and ampacity ratings.

C. Doors: In panel front, with concealed hinges. Secure with flush catch and tumbler lock, all keyed alike.

D. Provide AIC ratings for panels as specified on drawings.

2.4 DISTRIBUTION PANELBOARDS

A. Doors: In panel front secure with tumbler lock, all keyed alike.

B. Branch-Circuit Breakers: Where OCPDs are indicated to be circuit breakers, use bolt-on breakers except circuit breakers 225-ampere frame size and greater may be plug-in type where individual positive locking device requires mechanical release for removal.

C. Provide AIC ratings for panels as specified on drawings.

2.5 IDENTIFICATION

A. General: Refer to Division 16 Section "Electrical Identification" for labeling materials.

B. Panelboard Nameplates: Engraved laminated plastic or metal nameplate for each panelboard mounted with stainless screws.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install panelboards and accessory items in accordance with NEMA PB 1.1, "General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less" and manufacturers' written installation instructions.

B. Mounting Heights: Top of trim 74 inches above finished floor, except as indicated.

C. Mounting: Plumb and rigid without distortion of box. Mount flush panels uniformly flush with wall finish.

D. Circuit Directory: Typed and reflective of final circuit changes required to balance panel loads. Obtain approval before installing.

E. Install filler plates in unused spaces.

F. Provision for Future Circuits at Flush Panelboards: Stub four 1-inch empty conduits from panel into accessible ceiling space or space designated to be ceiling space in future. Stub four 1-inch empty conduits into raised floor space or below slab other than slabs on grade.

G. Auxiliary Gutter: Install where a panel is tapped to a riser at an intermediate location.

H. Wiring in Panel Gutters: Train conductors neatly in groups, bundle, and wrap with wire ties after completion of load balancing.

3.2 IDENTIFICATION

A. Identify field-installed wiring and components and provide warning signs in accordance with Division 16 Section "Electrical Identification."

3.3 GROUNDING

A. Connections: Make equipment grounding connections for panelboards as indicated.

B. Provide ground continuity to main electrical ground bus indicated.

3.4 CONNECTIONS

A. Tighten electrical connectors and terminals, including grounding connections, in accordance with manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.5 FIELD QUALITY CONTROL

A. Visual and Mechanical Inspection: Include the following inspections and related work:

1. Inspect for defects and physical damage, labeling, and nameplate compliance with requirements of up-to-date drawings and panelboard schedules.
2. Exercise and perform of operational tests of all mechanical components and other operable devices in accordance with manufacturer's instruction manual.
3. Check panelboard mounting, area clearances, and alignment and fit of components.
4. Check tightness of bolted electrical connections with calibrated torque wrench. Refer to manufacturer's instructions for proper torque values.
5. Perform visual and mechanical inspection and related work for overcurrent protective devices as specified in Division 16 Section "Overcurrent Protective Devices."

3.6 CLEANING

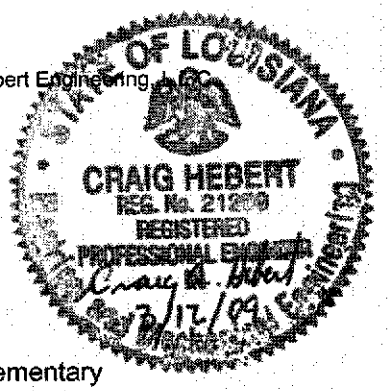
A. Upon completion of installation, inspect interior and exterior of panelboards. Remove paint splatters and other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish.

3.7 COMMISSIONING

A. Balancing Loads: After Substantial Completion, but not more than two months after Final Acceptance, conduct load-balancing measurements and circuit changes as follows:

1. Perform measurements during period of normal working load as advised by the Owner.
2. Perform load-balancing circuit changes outside the normal occupancy/working schedule of the facility. Make special arrangements with Owner to avoid disrupting critical 24-hour services such as FAX machines and on-line data processing, computing, transmitting, and receiving equipment.
3. Recheck loads after circuit changes during normal load period. Record all load readings before and after changes and submit test records.
4. Tolerance: Difference between phase loads exceeding 20 percent at any one panelboard is not acceptable. Rebalance and recheck as required to meet this minimum requirement.

END OF SECTION 16470



SECTION 16475 - FUSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Fuses.

2.2 QUALITY ASSURANCE

A. Comply with NFPA 70 "National Electrical Code" for components and installation.

B. Listing and Labeling: Provide products specified in this Section that are listed and labeled.
1. The Terms "Listed" and "Labeled": As defined in the "National Electrical Code," Article 100.
2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

C. Single-Source Responsibility: All fuses shall be the product of a single manufacturer.

2.3 EXTRA MATERIALS

A. Furnish the following extra materials that match products installed, packaged with protective covering for storage, and with identification labels clearly describing contents.

B. Spare Fuses: Furnish quantity equal to 20 percent of each fuse type and size installed, but not less than 1 set of 3 of each type and size.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide fuses by one of the following:

1. Bussmann Div., Cooper Industries, Inc., FRS-R, LPS-RK
2. Reliance Fuse, SCLR, ECSR

2.2 PLUG FUSES

A. Type: UL 198F, Type S, dual element, time delay. Current limiting fuses.

2.3 CARTRIDGE FUSES

A. Characteristics: NEMA FU 1 nonrenewable cartridge fuse, class as specified or indicated, current rating as indicated, voltage rating consistent with circuit voltage.

B. Main Feeders: Class J time delay.

C. Motor Branch Circuits: Class RK1 time delay.

D. Other Branch Circuits: Class RK5 non-time delay.

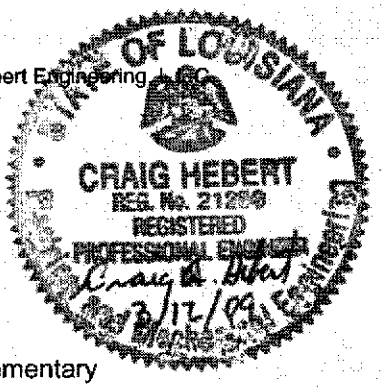
E. The fuses shall be rated to meet a maximum AIC rating of 65,000 Amps or as indicated based upon panel serving equipment.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install fuses in fusible devices as indicated. Arrange fuses so that fuse ratings are readable without removing fuse.

END OF SECTION 16475



SECTION 16476 - DISCONNECTS AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Feeder and equipment disconnects.
2. Enclosed circuit breakers.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 16 Section "Fuses."

1.3 SUBMITTALS

A. General: Submit the following according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product data for switches, circuit breakers, and accessories specified in this Section.

1.4 QUALITY ASSURANCE

A. Comply with NFPA 70 "National Electrical Code" for components and installation.

B. Listing and Labeling: Provide products specified in this Section that are listed and labeled.

1. The Terms "Listed" and "Labeled": As defined in the "National Electrical Code," Article 100.
2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

C. Single-Source Responsibility: All enclosed switches and circuit breakers shall be the product of a single manufacturer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide enclosed switches and circuit breakers by one of the following:

1. Square D Co.
2. General Electric, Inc.
3. Cutler Hammer, Inc.

2.2 ENCLOSED SWITCHES

A. Enclosed Fusible Switch, 800 Amperes and Smaller: NEMA KS 1, Type HD, clips to accommodate specified fuses, enclosure consistent with environment where located, handle lockable with 2 padlocks, and interlocked with cover in CLOSED position. Disconnects shall be

heavy duty type.

B. Enclosure: NEMA KS 1, Type 1, unless specified or required otherwise to meet environmental conditions of installed location.

1. Outdoor Locations: Type 3R. and heavy duty type.
2. Other Wet or Damp Indoor Locations: Type 3R.

C. Switches and fuses shall meet the minimum AIC rating of the distribution panel as indicated.

2.3 ENCLOSED CIRCUIT BREAKERS

A. Enclosed Molded-Case Circuit Breaker: NEMA AB 1, handle lockable with 2 padlocks.

B. Characteristics: Frame size, trip rating, number of poles, and auxiliary devices as indicated; interrupting capacity rating to meet available fault current, 10,000 symmetrical rms amperes minimum; with appropriate application listing when used for switching fluorescent lighting loads or heating, air conditioning, and refrigeration equipment.

C. Interchangeable Trips: Circuit breakers, 200 amperes and larger, with trip units interchangeable within frame size.

D. Field-Adjustable Trips: Circuit breakers, 400 amperes and larger, with adjustable short time and continuous current settings.

E. Lugs: Mechanical lugs and power-distribution connectors for number, size, and material of conductors and minimum A/C rating indicated.

F. Enclosure: NEMA AB 1, Type 1, unless specified or required otherwise to meet environmental conditions of installed location.

1. Outdoor Locations: Type 3R.
2. Other Wet or Damp Indoor Locations: Type 3R.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install enclosed switches and circuit breakers in locations as indicated, according to manufacturer's written instructions.

B. Install enclosed switches and circuit breakers level and plumb.

C. Install wiring between enclosed switches and circuit breakers and control/indication devices.

D. Connect enclosed switches and circuit breakers and components to wiring system and to ground as indicated and instructed by manufacturer. Tighten connectors and terminals, including screws and bolts according to equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals according to tightening torques specified in UL Standard 486A.

3.2 FIELD QUALITY CONTROL

A. Testing: After installing enclosed switches and circuit breakers and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements.

B. Correct malfunctioning units at site, where possible, and retest to demonstrate compliance; otherwise, remove and replace with new units, and retest.

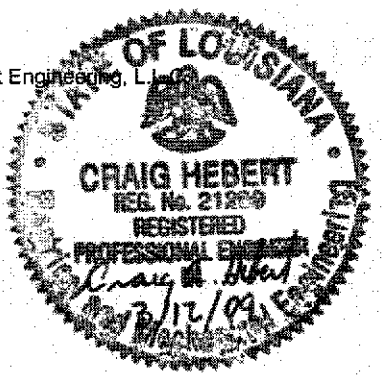
3.3 ADJUSTING

A. Set field-adjustable enclosed switches and circuit breaker trip ranges.

3.4 CLEANING

A. After completing system installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finish including chips, scratches, and abrasions.

END OF SECTION 16476



SECTION 16515 - INTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes interior lighting fixtures, lamps, ballasts, emergency lighting units, and accessories.

B. Related Sections: The following Division 16 Sections contain requirements that relate to this Section:
   1. "Exterior Lighting Fixtures" for exterior security lighting, roadway and parking lot lighting, poles, and standards.

C. Where a "Standard Specification" (i.e. ANSI, UL, etc.) is referenced and no manufacturers are listed the Contractor shall submit manufacturers for Prior Approval in adherence with the specified standard, and in accordance with Section 16050.

1.3 DEFINITIONS

A. Emergency Lighting Unit: A fixture with integral emergency battery power supply and the means for controlling and charging the battery. They are also known as an emergency light set. Emergency units are available with integral lamps only.

B. Fixture: A complete lighting unit, exit sign, or emergency lighting unit. Fixtures include lamps and parts required to distribute the light, position and protect lamps, and connect lamps to the power supply.

C. Luminaire: Fixture.

D. Average Life: The time after which 50 percent will have failed and 50 percent will have survived under normal conditions.

1.4 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

B. Product data describing fixtures, lamps, ballasts, and emergency lighting units. Arrange product data for fixtures in order of fixture designation. Include data on features and accessories and the following information:

   1. Outline drawings of fixtures indicating dimensions and principal features.
   2. Electrical ratings and photometric data with specified lamps and certified results of independent laboratory tests.
   3. Data on batteries and chargers of emergency lighting units.

1.5 QUALITY ASSURANCE

A. Comply with NFPA 70 "National Electrical Code" for components and installation.

B. Listing and Labeling: Provide fixtures and emergency lighting units that are listed and labeled for their indicated use on the Project.

1. Special Listing and Labeling: Provide fixtures for use in damp or wet locations, underwater, and recessed in combustible construction specifically listed and labeled for such use. Provide fixtures for use in hazardous (classified) locations that are listed and labeled for the specific hazard.
2. The terms "Listed" and "Labeled": As defined in the National Electrical Code, Article 100.
3. Listing and Labeling Agency Qualification: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

C. Manufacturers Qualifications: Firms experienced in manufacturing fixtures that are similar to those indicated for this Project and that have a record of successful in-service performance.

D. Coordination of Fixtures With Ceiling: Coordinate fixtures mounting hardware and trim with the ceiling system.

PART 2 - PRODUCTS

2.1 FIXTURES, GENERAL

A. Comply with the requirements specified in the Articles below, lighting fixture data sheet at the end of this Section, and lighting fixture schedule.

2.2 FIXTURE COMPONENTS, GENERAL

A. Metal Parts: Free from burrs and sharp corners and edges.

B. Sheet Metal Components: Steel, except as indicated. Components are formed and supported to prevent warping and sagging.

C. Doors, Frames, and Other Internal Access: Smooth operating and free from light leakage under operating conditions. Arrange to permit relamping without use of tools. Arrange doors, frames, lenses, diffusers, and other pieces to prevent accidental falling during relamping and when secured in the operating position.

D. Reflecting Surfaces: Minimum reflectances as follows, except as otherwise indicated:
1. White Surfaces: 85 percent.
2. Specular Surfaces: 83 percent.
3. Diffusing Specular Surfaces: 75 percent.
4. Laminated Silver Metallized Film: 90 percent.

E. Lenses, Diffusers, Covers, and Globes: 100 percent virgin acrylic plastic or water white, annealed crystal glass except as indicated.
1. Plastic: Highly resistance to yellowing and other changes due to aging, exposure to heat and UV radiation.
2. Lens Thickness: 0.125 inches, minimum.

2.3 FLUORESCENT FIXTURES

A. Fixtures: Conform to UL 1570, "Fluorescent Lighting Fixtures."

B. Ballasts: Conform to UL 935, "Fluorescent-Lamp Ballasts."

C. Low Temperature Ballast Minimum Starting Temperature: Minus 20 deg C.

D. Ballast for operation of four foot (4') F32T8 rapid start fluorescent lamps shall be as follows:
   1. Operate lamps in instant start mode.
   2. Operate multiple lamps as parallel circuit, operating remaining lamp(s) at full light output upon failure of other lamp(s) connected to the same ballast.
   3. Enclosures shall be painted steel, plastic enclosures are not acceptable.
   4. Individual ballasts specifically designed, and UL listed, to operate, one, two, three, or four lamps as scheduled on the drawings.
   5. Operate lamps at rated lumen output and life specified by lamp manufacturer.
   6. Operate lamps at a frequency higher than 20 kHz.
   7. Operate a rated circuit voltage (120 or 277 VAC) at an input frequency of 60 Hz, and tolerate +/- 10% sustained voltage variation without damage to the ballast, and maintain light output at +/- 10% voltage variation.
   8. Comply with EMI and RFI limits set by the FCC (CRF 47 Part 18) for non-consumer applications and not interfere with normal electrical equipment.
   9. Power factor shall be not less than 0.95.
   10. Less than 20% Total Harmonic Distortion.
   11. Lamp Crest Factor shall be 1.7 or less.
   12. Ballast Factor shall be greater than .85.
   13. Sound rating shall be "A".
   14. Shall withstand transients as specified by ANSI C.62.41 for location category A.
   15. Meet applicable ANSI standards.
   16. A five (5) year warranty.

2.4 HIGH INTENSITY DISCHARGE (HID) FIXTURES

A. Fixtures: Conform to UL 1572, "High-Intensity Discharge Lighting Fixtures."

B. Ballasts: Conform to UL 1029, "High-Intensity-Discharge Lamp Ballasts" and ANSI C82.4, "Ballasts for High-Intensity-Discharge and Low-Pressure Sodium Lamps (Multiple-Supply Type)." Provide ballasts with the following features, except as otherwise indicated.
   1. Constant wattage autotransformer (CWA) or regulator, high-power-factor type.
   2. Voltage rating matches system voltage.
   3. Single-Lamp Ballasts: Minimum starting temperature of minus 30 deg C.
   4. Open circuit operation will not reduce the average life.
   5. High pressure sodium (HPS) ballasts incorporate a solid-state ignitor/starter with an average life in the pulsing mode of 10,000 hours at an ignitor/starter case temperature of 90 deg C.
   6. Noise Suppression: Manufacturer's standard epoxy encapsulated model designed to minimize audible fixture noise.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Setting and Securing: Set units plumb, square, and level with ceiling and walls, and secure according to manufacturer's printed instructions and approved shop drawings.

B. Support For Recessed and Semirecessed Fixtures: Install ceiling system support wires at a minimum of four wires per fixture located not more than 6 inches from fixture corners.

   1. Fixtures Smaller Than Ceiling Grid: Install a minimum of four wires for each fixture and locate at corner of the ceiling grid where the fixture is located. Do not support fixtures by ceiling acoustical panels.
   2. Fixtures of Sizes Less Than Ceiling Grid: Center in the acoustical panel. Support fixtures independently with at least two 3/4-inch metal channels spanning and secured to the ceiling tees.
   3. Install support clips for recessed fixtures, securely fastened to ceiling grid members, at or

near each fixture corners.

C. Lamping: Lamp units according to manufacturer's instructions.

3.2 FIELD QUALITY CONTROL

A. Inspect each installed fixture for damage. Replace damaged fixtures and components.

B. Tests: Verify normal operation of each fixture after fixtures have been installed and circuits have been energized with normal power source. Interrupt electrical energy to demonstrate proper operation of emergency lighting installation.

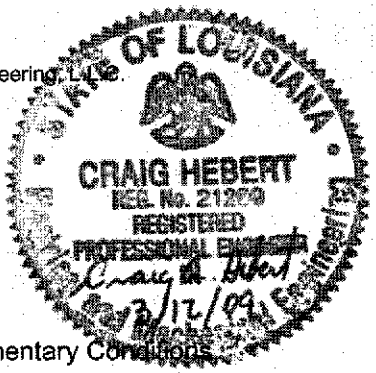
C. Replace or repair malfunctioning fixtures and components, then retest. Repeat procedure until all units operate properly.

3.3 ADJUSTING AND CLEANING

A. Clean fixtures upon completion of installation. Use methods and materials recommended by manufacturer.

B. Adjust aimable fixtures to provide required light intensities.

END OF SECTION 16515



SECTION 16525 - EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes exterior lighting fixtures, lamps, ballasts, poles standards, and accessories.

B. Related Sections: The following Division 16 Sections contain requirements that relate to this Section:

1. "Interior Lighting" for interior fixtures, lamps, ballasts, emergency lighting units, and accessories.

C. Where a "Standard Specification" (i.e. ANSI, UL, etc.) is referenced and no manufacturers are listed the Contractor shall submit manufacturers for Prior Approval in adherence with the specified standard, and in accordance with Section 16050.

1.3 DEFINITIONS

A. Fixture: A complete lighting unit. Fixtures include a lamp or lamps and parts required to distribute the light, position and protect lamps, and connect lamps to the power supply.

B. Lighting Unit: A fixture, or an assembly of fixtures with a common support, including a pole or bracket plus mounting and support accessories.

C. Luminaire: A fixture.

1.4 SUBMITTALS

A. General: Submit the following according to Conditions of Contract and Division 1 Specification Sections.

B. Product data describing fixtures, lamps, ballasts, poles, and accessories. Arrange product data for fixtures in order of fixture designation. Include data on features, poles, accessories, and the following:

1. Outline drawings of fixtures and poles indicating dimensions and principal features.
2. Electrical ratings and photometric data with certified results of independent laboratory tests.

1.5 QUALITY ASSURANCE

A. Comply with NFPA 70 "National Electrical Code" for components and installation.

B. Comply with ANSI C2, "National Electrical Safety Code."

C. Listing and Labeling: Provide fixtures and accessories that are listed and labeled for their indicated use and location on the Project.
1. Special Listing and Labeling: Provide lighting units for use under water that are specifically listed and labeled for such use. Provide lighting units for hazardous (classified) locations that are listed and labeled for the specific hazard.

2. The Terms "Listed" and "Labeled": As defined in the "National Electrical Code," Article 100.
3. Listing and Labeling Agency Qualification: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

D. Manufacturers' Qualifications: Firms experienced in manufacturing lighting units that are similar to those indicated for this Project and that have a record of successful in-service performance.

1.6 STORAGE AND HANDLING OF POLES

A. General: Store poles on decay-resistant treated skids at least 1 foot above grade and vegetation. Support pole to prevent distortion and arrange to provide free air circulation.

B. Metal Poles: Retain factory-applied pole wrappings until just before pole installation. For poles with nonmetallic finishes, handle with web fabric straps.

PART 2 - PRODUCTS

2.1 FIXTURE COMPONENTS, GENERAL

A. Metal Parts: Free from burrs and sharp edges and corners.

B. Sheet Metal Components: Corrosion-resistant aluminum, except as indicated. Form and support to prevent warping and sagging.

C. Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use. Provide filter/breather for enclosed fixtures.

D. Doors, Frames, and Other Internal Access Provisions: Smooth operating, free from light leakage under operating conditions, and arranged to permit relamping without use of tools. Arrange doors, frames, lenses, diffusers, and other pieces to prevent accidental falling during relamping and when secured in the operating position. Provide for door removal for cleaning or replacing lens. Arrange for door opening to disconnect ballast.

E. Exposed Hardware Material: Stainless steel.

F. Reflecting Surfaces: Minimum reflectances as follows, except as otherwise indicated:
1. White Surfaces: 85 percent.
2. Specular Surfaces: 83 percent.
3. Diffusing Specular Surfaces: 75 percent.

G. Plastic Parts: Resistant to yellowing and other changes due to aging and exposure to heat and UV radiation.

H. Lenses and Refractors: Materials as indicated. Use heat- and aging-resistant, resilient gaskets to seal and cushion lens and refractor mounting in fixture doors.

2.2 HIGH-INTENSITY-DISCHARGE (HID) FIXTURES

A. Fixtures: Conform to UL 1572, "High-Intensity-Discharge Lighting Fixtures."

B. Ballasts: Conform to UL 1029, "High-Intensity-Discharge Lamp Ballasts" and ANSI C82.4, "Ballasts for High-Intensity-Discharge and Low-Pressure Sodium Lamps (Multiple-Supply Type)." Provide constant wattage autotransformer (CWA) or regulating high-power-factor type, unless otherwise

indicated.

1. Operating voltage matches system voltage.
2. Single-Lamp Ballasts: Minimum starting temperature of minus 30 deg C.
3. Construct ballasts so open circuit operation will not reduce the average life.
4. Noise: Uniformly quiet operation, with a noise rating of B or better.

2.3 FIXTURE SUPPORT COMPONENTS

A. Pole-Mounted Fixtures: Conform to AASHTO LTS-1, "Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals."

B. Wind-Load Strength: 100 mph (160 km/h) and 1.3 gust factor for total support assembly, including pole, base, and anchorage, where used, to carry the fixtures, supports, and appurtenances at the indicated heights above grade without deflection or whipping.

C. Arm, Bracket, and Tenon Mount Materials: Match the poles.

D. Mountings, Fastenings, and Appurtenances: Corrosion-resistant components compatible with the poles and fixtures that will not cause galvanic action at contact points. Provide mountings that will correctly position the luminaire to provide the indicated light distribution.

E. Pole Bases: Anchor type with galvanized steel hold-down or anchor bolts, leveling nuts, and bolt covers.

F. Metal Pole Grounding Provisions: Welded 1/2-inch (13 mm) threaded lug, accessible through handhole.

G. Metal Pole Brackets: Designed to match pole metal. Provide cantilever brackets without underbrace, in the sizes and styles indicated, with straight tubular end section to accommodate the fixture.

H. Pole-Top Tenons: Fabricated to support the fixture indicated and securely fastened to the pole top.

2.4 LAMPS

A. Conform to ANSI Standards, C78 series, applicable to each type of lamp. Provide fixtures with indicated lamps. Where lamps are not indicated, provide lamps recommended by manufacturer.

2.5 FINISH

A. Metal Parts: Manufacturer's standard finish except as otherwise indicated. Finish applied over corrosion-resistant primer, free of streaks, runs, holidays, stains, blisters, and similar defects. Remove poles, fixtures, and accessories showing evidence of corrosion or finish failure during Project warranty period and replace with new items.

B. Other Parts: Manufacturer's standard finish except as otherwise indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Set units plumb, square, level, and secure according to manufacturer's written instructions and shop drawings.

B. Pole Installation: Use fabric web slings (not chain or cable) to raise and set poles.

C. Fixture Attachment: Fasten to indicated structural supports.

D. Fixture Attachment with Adjustable Features or Aiming: Attach fixtures and supports to allow aiming for indicated light distribution.

E. Lamp fixtures with indicated lamps according to manufacturer's instructions. Replace malfunctioning lamps.

3.2 GROUNDING

A. Ground fixtures and metal poles according to Division 16 Section "Grounding."

1. Poles: Install 10-foot driven ground rod at each pole.
2. Nonmetallic Poles and Poles on Parking Garage: Ground metallic components of lighting unit and foundations. Connect fixtures to grounding system with No. 6 AWG conductor.

3.3 FIELD QUALITY CONTROL

A. Inspect installed units for damage.

B. Tests: Verify normal operation of lighting units after installing fixtures and energizing circuits with normal power source.

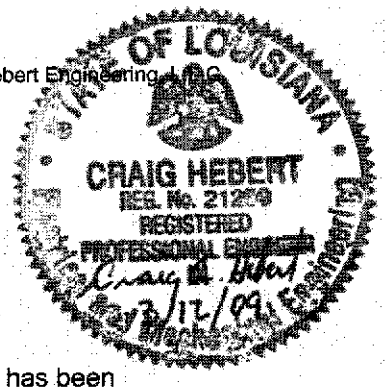
C. Replace or repair damaged and malfunctioning units and retest.

3.4 ADJUSTING AND CLEANING

A. Clean components on completion of installation. Use methods and materials recommended by manufacturer.

B. Adjust aimable fixtures to provide required light intensities.

END OF SECTION 16525



SECTION 16621 - NATURAL GAS GENERATOR

PART 1 -GENERAL

1.1 SCOPE OF WORK

A. It is the intent of this specification to secure an engine driven generator set that has been prototype tested, factory built, production tested, and site tested, together with all accessories necessary for a complete installation as shown on the plans and drawings and specified herein. All equipment shall be new and of current production by a firm which manufactures the generator and controls. The emergency generator set shall be MTU onsite energy model N250FRZ4 as furnished by KDM Sales & Service. Any request for approval of another product must be received no later than 14 days prior to the bid date. This request must include a detailed description of the proposed equipment with a listing of exceptions and adequate engineering data to substantiate approval. Incomplete submittal data that causes the specifying authority to ponder as to what is being proposed will be rejected. There will be no exceptions to these requirements.

1.2 GENERAL REQUIREMENTS

A. It is the intent of this specification to secure a generator system that has been tested during design verification, production and at the final job site. The generator set will be of the latest commercial design and will be complete with all of the necessary accessories for complete installation as shown on the plans, drawings, and specifications herein. The equipment supplied and installed shall meet the requirements of the National Electrical Code, along with all applicable local codes and regulations. All equipment shall be new and of current production of a national firm which manufactures the generator and controls, transfer switches, switchgear, and assembles the generator sets as a complete and coordinated system. There will be one source responsibility for warranty, parts, and service through a local representative with factory-trained servicemen.

1.3 SUBMITTAL

A. The submittal shall include:
   1. Prototype test certification and specification sheets showing all standard and optional accessories to be supplied.
   2. Schematic wiring diagrams.
   3. Dimension drawings.
   4. Interconnection diagrams identified by terminal number.
   5. Each required interconnection between the generator set, the transfer switch and the remote annunciator panel if it is included elsewhere in these specifications.

1.4 TESTING

A. To assure that the equipment has been designed and built to the highest reliability and quality standards, the manufacturer and/or local representative shall be responsible for three separate tests: design prototype tests, final production tests, and site tests.

1.5 DESIGN PROTOTYPE TESTS

A. Components of the emergency system such as the engine/generator set, transfer switch, and accessories shall not be subjected to prototype tests since the tests are potentially damaging. Rather, similar design prototypes and preproduction models, which will not be sold, shall have been used for the following tests:
   1. Maximum power (Kw).
   2. Maximum motor starting (kVA) at 35% instantaneous voltage dip.
   3. Alternator temperature rise by embedded thermocouple and/or by resistance method per NEMA MG1-22.40 and 16.40.

4. Governor speed regulation under steady-state and transient conditions.
5. Voltage regulation and generator transient response.
6. Fuel consumption at 1/4, 1/2, 3/4, and full load.
7. Harmonic analysis, voltage waveform deviation, and telephone influence factor.
8. Three-phase short circuit tests.
9. Alternator cooling air flow.
10. Torsional analysis to verify that the generator set is free of harmful torsional stresses.
11. Endurance testing.

B. Production Tests:
   1. Each generator set shall be tested under varying loads with guards and exhaust system in place. Tests shall include:
      a. Start Stop Test.
      b. Single-step load pickup.
      c. Transient and steady—state governing.
      d. Safety shutdown device testing.
      e. Voltage Regulator Range Test.
      f. Rated Power @ 0.8 PF
      g. Maximum Power.

C. Upon request, arrangements to either witness this test will be made, or a certified test record will be sent prior to shipment.

1.6 SITE TESTS

A. An installation check, start-up, and building load test shall be performed by the manufacturer's local representative. The engineer, regular operators, and the maintenance staff shall be notified of the time and date of the site test. The tests shall include:
   1. Fuel, lubricating oil, and antifreeze shall be checked for conformity to the manufacturer's recommendations, under the environmental conditions present and expected.
   2. Accessories that normally function while the set is standing by shall be checked prior to cranking the engine. These shall include: block heaters, battery charger, remote annunciator, etc.
   3. Start-up under test mode to check for exhaust leaks, path of exhaust gases outside the building, cooling air flow, movement during starting and stopping, vibration during running, normal and emergency line-to-line voltage and frequency, and phase rotation.
   4. Automatic start-up by means of simulated power outage to test remote- automatic starting, transfer of the load, and automatic shutdown. Prior to this test, all transfer switch timers shall be adjusted for proper system coordination. Engine coolant temperature, oil pressure, and battery charge level along with generator voltage, amperes, and frequency shall be monitored throughout the test.

1.7 WARRANTY AND MAINTENANCE

A. The generator set shall be guaranteed against defective material and workmanship in accordance with the manufacturer's published warranty for two years from date of start-up. Optional warranties shall be available upon request.

B. The generator set manufacturer and its distributor shall maintain a 24-hour parts and service organization. This organization shall be regularly engaged in a maintenance contract program to perform preventive maintenance and service on equipment similar to that specified. A service agreement shall be available and shall include system operation under simulated operating conditions, adjustment to the generator, transfer switch, and switchgear controls as required, and certification in the owner's maintenance log of repairs made and proper functioning of all systems.

PART 2 - ENGINE AND COMPONENTS

2.1 EQUIPMENT

A. The generator set shall be capable of this rating while operating in an ambient condition of 118 °F (47.8 °C) and 1500 feet above sea level.

B. Spring type vibration isolators shall be provided between the engine-generator steel base and the slab.

2.2 GOVERNING SYSTEM

A. Isochronous Zero Speed Droop Governing System:
   1. The engine generator set shall be provided with a precision electronic governor of the constant speed type. The governor shall be capable of maintaining a steady state bandwidth of not more than ±0.25%, at any constant load, from no load to full load. The governor shall maintain governed speed at 60 Hertz at any load, from no load to full load.

2.3 ENGINE: NATURAL GAS FUELED

A. The 855 cubic-inch-displacement engine shall deliver a minimum of 395 hp at a governed speed of 1800 rpm.

B. The engine shall be equipped with the following:
   1. A 24 Volt positive engagement solenoid shift-starting motor.
   2. An automatic battery charging alternator with solid-state voltage regulation.
   3. A positive displacement, full pressure lubrication oil pump, cartridge oil filters, dipstick, and oil drain.
   4. A dry-type replaceable air cleaner elements for normal applications.

C. The turbocharged engine shall be fueled with natural gas and be supplied with a unit-mounted electric solenoid fuel shut-off valve, flexible fuel line, and secondary fuel pressure regulator.

D. The engine shall have a minimum of 6 cylinders, and be liquid-cooled by a unit-mounted radiator, blower fan, water pump, and thermostats.

E. This system shall properly cool the engine with up to 0.5 inches H20 static pressure on the fan in an ambient temperature up to 118 °F (47.8 °C)

2.4 GENERATOR AND COMPONENTS

A. Main Building Generator		Water Plant Generator	
1.	KVA: 406.25	1.	KVA: 225.0
2.	Volts: 277/480	2.	Volts: 277/480
3.	Phase: 3	3.	Phase: 3
4.	PF: .8	4.	PF: .8
5.	Hertz: 60	5.	Hertz: 60
6.	RPM: 1800	6.	RPM: 1800

B. The alternator shall be salient-pole, brushless, 12-lead reconnectable, self-ventilated of drip-proof construction with amortisseur rotor windings and skewed stator for smooth voltage waveform. The insulation shall meet the NEMA standard (MG1-22.40 and 16.40) for Class H and be insulated with epoxy varnish to be fungus resistant per MIL 1-24092. Temperature rise of the rotor and stator shall be limited to NEMA Class F ratings. The excitation system shall be of brushless construction controlled by a solid- state voltage regulator capable of maintaining voltage within +/-

2% at any constant load from 0% to 100% of rating. The regulator must be isolated to prevent tracking when connected to SCR loads, and provide individual adjustments for voltage range, stability and volts-per-hertz operations; and be protected from the environment by conformal coating.

C. The generator set shall meet the transient performance requirements of ISO 8528-5, level G-2 .

D. The generator, having a single maintenance-free bearing, shall be directly connected to the flywheel housing with a semi-flexible coupling between the rotor and the flywheel.

E. The permanent magnetic generator shall be inherently capable of sustaining at least 250% of rated current for at least 10 seconds under a 3-phase symmetrical short circuit without the addition of separate current support devices.

2.5 PERMANENT MAGNETIC GENERATOR

A. PMG EXCITATION SYSTEM

1. The generator shall be equipped with a 300/250 Hz permanent magnet generator excitation system. Both the PMG and the rotating brushless exciter shall be mounted outboard of the bearing. The system shall supply a minimum short circuit support current of 300% of the rating(250% for 50 hertz operation) for 10 seconds. The rotating exciter shall use a three phase fullwave rectifier assembly with hermetically sealed silicon diodes protected against abnormal transient conditions by a multi-plate selenium surge protector. The diodes shall be designed for safety factors of 5 times voltage and 3 times current. Provide factory alternator data sheet with shop drawing submittal.

2.6 VOLTAGE REGULATOR

A. The DVR2000 voltage regulator shall be a digital, microprocessor design with solid state voltage build-up. No voltage build-up relay or other relays are acceptable. The unit shall be encapsulated for humidity and abrasion protection. The regulator shall include ¼% regulation, true volts per hertz operation with adjustable cut in, loss of sensing continuity shutdown, over excitation shutdown, three phase RMS sensing, over voltage protection, and provisions for parallel operation.

2.7 PERFORMANCE

A. The voltage regulation shall be ¼% from no load to full load and 5% frequency variation. Regulator drift shall be less than ½% per 72°F (40°C) ambient temperature change. The voltage regulator shall be a static-type using non-aging silicon controlled rectifiers, with electromagnetic interference suppression to MIL-STD-461 C, part 9, when mounted in the generator conduit box. The waveform harmonic distortion shall not exceed 5% total RMS measured line to line at full rated load. The TIF factor shall not exceed 50. Construction will allow connection to the load through the top, bottom or either side of the conduit box. The conduit box shall be constructed of heavy gauge sheet steel, capable of supporting up to 240 pounds of accessory control equipment. The conduit box shall contain two compartments; one housing the rotating rectifier and PMG; and the other the connection area and regulator. This is to separate the rotating elements from the load connection and voltage regulator adjustments. The regulator shall be mounted on the inside of the conduit box panel allowing access to adjust the regulator through a swinging dust cover from the outside of the conduit box, therefore avoiding the higher voltage generator terminals on the inside of the conduit box.

2.8 VERIFICATION OF PERFORMANCE

A. All certified performance and temperature rise test data submitted by the generator manufacturer

are to be the result of the actual test of the same or duplicate generators. Temperature rise data shall be the result of loaded, rated power factor heat runs at the rated voltage and hertz. All performance testing shall be done in accordance with MIL-STD-705 and/or IEEE Standard-115.

B. Controller:
   1. The control panel shall be microprocessor based, password protected, with a Liquid Crystal Display for monitoring Engine, Generator and fault parameters. The control shall be mounted on the generator set for easy viewing by the operator. The control shall be suitable for the environment where the generator set is installed. The control shall have but not be limited to the features listed below.

C. Standards:
   1. Control must meet NFPA-110 Level 1 requirements (2002 Edition) and must have an integral alarm horn as required by NFPA.NFPA-99 and NEC must also be accommodated.The generator set control must be listed under UL 508.
   2. The control must be usable on 12- or 24-volt starting systems.
   3. Environment:
      a. -40°C to +70°C operating temperature range.
      b. 5-95% humidity, non condensing.

D. Features:
   1. Microprocessor based.
   2. Password protected.
   3. Flash memory.
   4. Displays 18 engine/generator parameters.
   5. Has user programmable analog sender inputs for oil pressure, coolant temperature and fuel level .
   6. Controls engine starting and stopping.
   7. Programmable engine cranking.
   8. Programmable alarms and pre-alarms.
   9. Programmable inputs (3).
   10. Programmable outputs (2).
   11. Remote annunciation via 2-wire communications.
   12. UL Listed.
   13. CSA Certified.

2.9 OUTPUTS

A. Contact ratings: 30A @ 28Vdc make, break, and carry: crank, fuel solenoid, pre-start 2A @24Vdc make, break, and carry: (2) programmable

2.10 MONITORED PARAMETERS

A. Generator:
   1. The following generator functions must be monitored:
      a. all output voltages—single phase, three phase, line to line, and line to neutral.
      b. all single phase and three phase currents.
      c. output frequency.
      d. system power factor.
      e. total instantaneous kilowatt loading.

   2. The control must be capable of detecting the following conditions, indicate if the condition will shutdown the generator or provide a warning, and annunciate the situation, using words and phrases, on the digital display.

B. Engine:

1. Oil pressure.
2. Coolant temperature.
3. Fuel level.
4. Current (3 phases).
5. Battery voltage.
6. Hours to next service.
7. Total run time.
8. Engine RPM.

C. Generator Set Protection – Alarms:
1. Low oil pressure.
2. Overspeed.
3. Overcrank.
4. Emergency stop button input.
5. High coolant temperature.
6. Sender failure.
7. Low coolant level.
8. Low fuel level.

D. Generator Set Protection – Pre-Alarms:
1. Low oil pressure.
2. Low battery voltage.
3. Maintenance interval timer.
4. High coolant temperature.
5. Low coolant temperature.
6. High battery voltage.
7. Fuel leak.
8. Weak battery.
9. Low fuel level.
10. Battery charger failure.

E. Timers
1. Engine cooldown: 0 to 60 minutes.
2. Engine maintenance: 0 to 5000 hours.
3. Pre-Alarms time delays: week and low battery voltage: 1-10 seconds.
4. Alarm time delays:
   a. Overspeed: 0-500ms.
   b. Sender failure: 0-10 seconds.
5. Arming delays after crank disconnect:
   a. Low oil pressure: 5-15 seconds.
   b. High coolant temperature: 50-150 seconds.
   c. Pre-crank delay: 0-30 seconds.

F. System Programming:
1. It must be possible to disable programming so the system can only be monitored.
2. It shall be possible to program the control with the controller keypad or using an IBM compatible personal computer.
3. Programming access must be password protected.
4. The following must be programmable from the controller keypad:
   a. Time delay settings:
   1) enable times for auxiliary inputs.
   2) engine start.
   3) engine cooldown.
   4) crank on and crank pause time.
   b. Trip point settings:
   1) high battery voltage.

2) low battery voltage.
3) overspeed.

2.11 ACCESSORIES

A. Accessories:
1. Line circuit breaker of Nameplate AMPS (@ 125%) amperes, 3 poles, 600 volt rated, UL molded case type, generator mounted.
2. Engine block heater. Thermostatically controlled and sized to maintain manufacturers recommended engine coolant temperature to meet the start-up requirements of NFPA-99 and NFPA-110, Level 1.
3. Battery rack, and battery cables, capable of holding the manufacturer's recommended batteries, shall be supplied.
4. A 24-Volt lead-antimony battery(ies) capable of delivering the manufacturer's recommended minimum cold-cranking Amps required at 0°F, per SAE Standard J-537, shall be supplied.
5. Battery Charger – 24Volt, 5 AMP trickled charger.
6. The engine exhaust silencer shall be coated to be temperature and rust resistance, rated for critical application. The silencer will reduce total engine exhaust noise by 25-35 dB(A).
7. Gas-proof, seamless, stainless steel, flexible exhaust bellows with (threaded NPT) or (ASA 125 LB Flange) connection.
8. Flexible fuel line AGA rated 300°F and 100 psi ending in pipe thread.
9. A dry contact kit containing a single relay for energized to run functions.

B. Remote Annunciator:
1. KRDP 110-2 Wire Remote Annunciator Panels:
2. Panel Components:
a. Audible alarm horn rated at 80 dbSurface or flush mounting Lamp test and alarm silence switchesAnalog panel requires 12, 24 volt DC; Digital panel requires 12, 24 volt DC or 120 volt AC power supply input Conduit box with knockouts on top, bottom, and either sideAlarm conditions:
1) Switch not in auto .
2) Low coolant level .
3) High coolant temperature .
4) Low oil pressure .
5) Over-crank .
6) Over-speed .
7) Emergency stop .
8) Fuel Leak .
9) Sender failure.

C. Pre-alarms that can be enabled:
1. High coolant temperature.
2. Low coolant temperature.
3. Low oil pressure .
4. Low fuel level.
5. Battery over-voltage.
6. Weak battery.
7. Battery failure.

D. Other safety features displayed on panel are "display panel on" and "EPS supplying load".

2.12 HOUSING

A. WEATHERPROOF:
1. A weatherproof housing will be supplied which is of all aluminum construction for the

mechanical and electrical equipment used with the engine generator system. The housing will be constructed of minimum 14 gauge sheet aluminum and include fixed storm proof panels. The housing will be fully assembled at the factory and include bolted and welded construction. The muffler will be pre-mounted and include muffler clamps and brackets. The doors will give access for easy maintenance of the engine from both sides and control access from the end of the housing. All doors will be lift off hinged design and lockable. The design of the hinge will include stainless steel construction to ensure long life.

2.13 AUTOMATIC TRANSFER SWITCH

A. Scope:
   1. Furnish and install automatic transfer switches (ATS) with number of poles, amperage, voltage, and withstand current ratings as shown on the plans. Each automatic transfer shall consist of an inherently double throw power transfer switch unit and a microprocessor controller, interconnected to provide complete automatic operation. All transfer switches and control panels shall be the product of the same manufacturer.

B. Acceptable Manufacturers
   1. Automatic transfer switches shall be ASCO Series 300,. The prior approval requirements previously listed by this specification shall apply to the transfer switch.

C. Codes and Standards
   1. The automatic transfer switches and accessories shall conform to the requirements of:
      a. UL 1008 – Standard for Automatic Transfer Switches.
      b. NFPA 70 – National Electrical Code.
      c. NFPA 110 – Emergency and Standby Power Systems.
      d. IEEE Standard 446 – IEEE Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications
      e. NEMA Standard ICS10-1993 (formerly ICS2-447) – AC Automatic Transfer Switches.
      f. NEC Articles 700, 701, 702.
      g. International Standards Organization ISO 9001.

D. Mechanically Held Transfer Switch:
   1. The transfer switch unit shall be electrically operated and mechanically held. The electrical operator shall be a single-solenoid mechanism, momentarily energized. Main operators which include overcurrent disconnect devices will not be accepted. The switch shall be mechanically interlocked to ensure only one of two possible positions, normal or emergency.
   2. The switch shall be positively locked and unaffected by momentary outages so that contact pressure is maintained at a constant value and temperature rise at the contacts is minimized for maximum reliability and operating life.
   3. All main contacts shall be silver composition. Switches rated 600 amperes and above shall have segmented, blow-on construction for high withstand current capability and be protected by separate arcing contacts.
   4. Inspection of all contacts shall be possible from the front of the switch without disassembly of operating linkages and without disconnection of power conductors. A manual operating handle shall be provided for maintenance purposes. The handle shall permit the operator to manually stop the contacts at any point throughout their entire travel to inspect and service the contacts when required.
   5. Designs utilizing components of molded-case circuit breakers, contactors, or parts thereof which are not intended for continuous duty, repetitive switching or transfer between two active power sources are not acceptable.
   6. Where neutral conductors must be switched, the ATS shall be provided with fully-rated neutral transfer contacts.

7. Where neutral conductors are to be solidly connected, a neutral terminal plate with fully-rated AL-CU pressure connectors shall be provided.

E. Microprocessor Controller with Membrane Interface Panel:
1. The controller shall direct the operation of the transfer switch. The controller's sensing and logic shall be controlled by a built-in microprocessor for maximum reliability, minimum maintenance, and inherent serial communications capability. The controller shall be connected to the transfer switch by an interconnecting wiring harness. The harness shall include a keyed disconnect plug to enable the controller to be disconnected from the transfer switch for routine maintenance.
2. The controller shall be enclosed with a protective cover and be mounted separate from the transfer switch unit for safety and ease of maintenance. Sensing and control logic shall be provided on printed circuit boards. Interfacing relays shall be industrial grade plug-in type with dust covers.
3. The controller shall meet or exceed the requirements for Electromagnetic Compatibility (EMC) as follows:
   a. ANSI C37.90A/IEEE 472 Voltage Surge Test.
   b. NEMA ICS – 109.21 Impulse Withstand Test.
   c. IEC801-2 Electrostatic discharge (ESD) immunity.
   d. ENV50140 and IEC 801 – 3 Radiated electromagnetic field immunity.
   e. IEC 801 – 4 Electrical fast transient (EFT) immunity .
   f. ENV50142 Surge transient immunity.
   g. ENV50141: Conducted radio-frequency field immunity.
   h. EN55011: Group 1, Class A conducted and radiated emissions
   i. EN61000 –4 – 11 Voltage dips and interruptions immunity.

F. Enclosure:
1. The ATS shall be furnished in a NEMA type 1 enclosure unless otherwise shown on the plans.
2. Provide strip heater with thermostat for Type 3R enclosure requirements.
3. Controller shall be flush-mounted display with LED indicators for switch position and source availability. It shall also include test and time delay bypass switches.

G. Voltage and Frequency Sensing:
1. The voltage of each phase of the normal source shall be monitored, with pickup adjustable to 95% of nominal and dropout adjustable from 70% to 90% of pickup setting.
2. Single-phase voltage and frequency sensing of the emergency source shall be provided.

H. Time Delays:
1. An adjustable time delay shall be provided to override momentary normal source outages and delay all transfer and engine starting signals.
2. An adjustable time delay shall be provided on transfer to emergency, adjustable from 0 to 5 minutes for controlled timing of transfer of loads to emergency.
3. An adjustable time delay shall be provided on retransfer to normal, adjustable to 30 minutes. Time delay shall be automatically bypassed if emergency source fails and normal source is acceptable.
4. A 5-minute cooldown time delay shall be provided on shutdown of engine generator.
5. All adjustable time delays shall be field adjustable without the use of tools.

I. Additional Features:
1. A set of gold-flashed contacts rated 10 amps, 32 VDC shall be provided for a low-voltage engine start signal. The start signal shall prevent dry cranking of the engine by requiring the generator set to reach proper output, and run for the duration of the cool down setting, regardless of whether the normal source restores before the load is transferred.
2. A push-button type test switch shall be provided to simulate a normal source failure.
3. A push-button type switch to bypass the time delay on transfer to emergency, the engine

exerciser period on the retransfer to normal time delay whichever delay is active at the time the push-button is activated.

4. Terminals shall be provided for a remote contact which opens to signal the ATS to transfer to emergency and for remote contacts which open to inhibit transfer to emergency and/or retransfer to normal.
5. Auxiliary contacts, rated 10 amps, 250 VAC shall be provided consisting of one contact, closed when the ATS is connected to the normal source and one contact, closed, when the ATS is connected to the emergency source.
6. Indicating lights shall be provided, one to indicate when the ATS is connected to the normal source (green) and one to indicate when the ATS is connected to the emergency source (red). Also provide indicating lights for both normal and emergency source availability.
7. Terminals shall be provided to indicate actual availability of the normal and emergency sources, as determined by the voltage sensing pickup and dropout settings for each source.
8. Engine Exerciser – An engine generator exercising timer shall be provided, including a selector switch to select exercise with or without load transfer.
9. Inphase Monitor – An Inphase monitor shall be inherently built into the controls. The monitor shall control transfer so that motor load inrush currents do not exceed normal starting currents, and shall not require external control of power sources. The inphase monitor shall be specifically designed for and be the product of the ATS manufacturer.
10. Selective Load Disconnect – A double throw contact shall be provided to operate after a time delay, adjustable to 20 seconds prior to transfer and reset 0 to 20 seconds after transfer. This contact can be used to selectively disconnect specific load(s) when the transfer switch is transferred. Output contacts shall be rated 6 amps at 28 VDC or 120 VAC.

J. Withstand and Closing Ratings:
1. The ATS shall be rated to close on and withstand the available rms symmetrical short circuit current at the ATS terminals with the type of overcurrent protection shown on the plans. WCR ATS ratings as be as follows when used with specific circuit breakers:
   a. **ATS Size-----Withstand & Closing Rating MCCB-----With Current Limiting Fuses**
   1) 30-200-------22,000A--------200,000.
   2) 225-400-------42,000A--------200,000.
   3) 600-1200------65,000A--------200,000.
   4) 1600-2000-----85,000A--------200,000.
   5) 2600-3000-----100,000A--------200,000.

K. Tests and Certification:
1. The complete ATS shall be factory tested to ensure proper operation of the individual components and correct overall sequence of operation and to ensure that the operating transfer time, voltage, frequency and time delay settings are in compliance with the specification requirements.

L. Manufacturer's Product Period of Warranty:
1. The automatic transfer switch shall be warranted by the manufacturer against defective materials and factory workmanship for a period of **2 years or 1500 hours**. Such defective parts shall be repaired or replaced at the manufacturer's option, free of charge. The warranty period shall commence when the standby system is first placed into service. Multiple warranties for individual components (engine, alternator, controls, etc.) will not be acceptable. Satisfactory warranty documents must be provided.

PART 3 - EXECUTION

3.1 GENERAL

A. The equipment shall be installed as shown on the plans, in accordance with the manufacturer's recommendation and all applicable codes.

3.2 SITE TEST

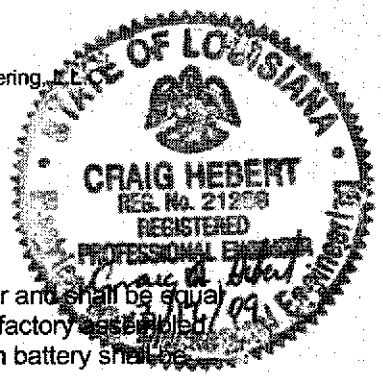
A. An installation check, start-up and building load test shall be performed by the manufacturer's local representative. The engineer, regular operators, and the maintenance staff shall be notified of the time and date of the site test. The tests shall include:
   1. Fuel, lubricating oil, and antifreeze (liquid cooled models) shall be checked for conformity to the manufacturer's recommendations under the environmental conditions present and expected.
   2. Accessories that normally function while the set is standing by shall be checked prior to cranking the engine. This shall include: engine heaters, battery charger, generator strip heaters, remote annunciator, etc.
   3. Start-up under test mode to check for exhaust leaks, path of exhaust gases outside the building, cooling air flow, movement during starting and stopping, vibration during running, normal and emergency line-to-line voltage and phase rotation.
   4. Automatic start-up by means of simulated power outage to test remote-automatic starting, transfer of the load, and automatic shutdown. Prior to this test, all transfer switch timers shall be adjusted for proper systems coordination. Engine temperature, oil pressure and battery charge level along with generator voltage, amperes, and frequency shall be monitored throughout the test.
   5. Load Bank test at full power for two (2) hours. Refill tank to maximum capacity once complete.

3.2 TRAINING

A. Provide six (6) hours of factory authorized training.

B. Field training shall cover all the items contained in the Operation and Maintenance Manuals.

END OF SECTION 16621



SECTION 16720 – INTRUSION DETECTION SYSTEM

PART 1 - GENERAL

The intrusion detection system equipment shall be the standard product of one manufacturer and shall be equal in performance and quality to that manufactured by Ademco. Equipment furnished shall be factory assembled and tested insofar as possible and field modifications will not be permitted. Stand-by time on battery shall be a minimum of 48 hours.

1.1 SCOPE

A. Contractor is to provide a complete security system with keypads, motion detectors, batteries, wiring, labor, and the main system.

B. The contractor shall provide pricing for a one year monitoring contract that may be secured by the owner at his option.

C. The main controller shall have up to eight partitions, shall be U.L. listed and must have at least 100 zones wired or multiplexed, relay outputs, 150 user codes, an event log history buffer, and a patented global polling technology.

D. The security system shall be an Ademco U.L. listed commercial fire alarm/burglar alarm communicator security panel. The Vista 100 security system shall be equipped with a 5140 DLM supervised dialer. Provide a battery to backup the security system in the case of power failure.

1.2 KEYPADS

A. Keypads shall be equal to Ademco #6160 with fixed English display and be for flush mounting in walls.

1.3 PASSIVE INFRARED DETECTORS

A. Passive infrared detectors shall be equal to Ademco #998MX, addressable wide angle with LED and temperature compensated. Units shall be adjustable and shall be set in a crossing pattern.

1.4 AUDIBLE ALARM DEVICE

A. Audible alarm devices shall be equal to Ademco ATW400, 8 ohm, 30-watt RMS weatherproof wet location sounder/horn, complete with tamper loop. Mount unit in a weatherproof cabinet with built-in tamper switches to sound alarm instantly if cabinet is opened, when system is in operation. Weatherproof unit is not acceptable in interior locations.

B. Interior horns shall be Ademco #747

PART 3 - EXECUTION

CONTINUITY OF SERVICE

3.1 INSTALLATION

A. Fasten equipment to structural members of building or metal supports attached to structure, or to concrete surfaces.

B. Use clamping devices for attaching to structural steel, or when clamping is impractical, obtain written authority to weld or to drill.

C. Fasten equipment to concrete or masonry with expansion anchors.

D. Fasten equipment to drywall by screws into studs, and to metal wall panels by weld studs, bolts or self-taping metal screws.

E. Do not install conduit raceways and boxes in positions that interfere with the work of other trades.

3.2 CONDUIT

A. Where run underground, exposed, or concealed within walls, install wiring in conduit as specified elsewhere in these specifications. Elsewhere, where concealed above accessible suspended ceilings, wiring may be run without conduit. Wiring run without conduit shall be identified by tags at intervals not exceeding 30 feet, shall be supported by "J-Hooks" at intervals not exceeding 4-feet, and shall be rated to be suitable for the environment in which it is installed – plenum rated for use in plenums.

3.3 WIRING

A. All power and signal cables shall be protected with lightning surge arresters of the silicon avalanche suppressor of Metal Oxide Varistor type.

B. Permanently label or mark each conductor at both ends with permanent alphanumeric wire markers. Labels shall indicate point of origin of cable. Utilize a consistent color code for system conductors throughout the installation.

3.4 WARRANTY AND OTHER SERVICES

A. The contractor shall warrant the entire system against mechanical and electrical defects for a period described in the contract general conditions. This period shall begin upon final acceptance of the system.

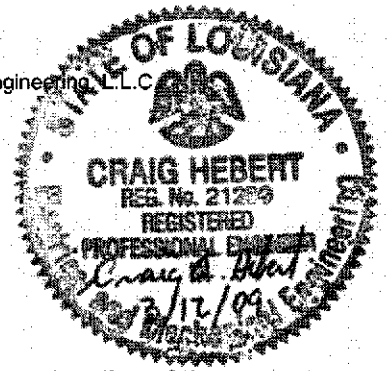
B. Furnish and install in accordance with manufacturer's instructions, all wiring, conduit, and outlet boxes for the system as described herein and on drawings. All wiring shall meet the requirements of all National, State and Local Electrical Codes. Final connections between equipment and wiring system shall be made under direct supervision of manufacturer's representative and a trained technician for the system. All connections to the system components shall be as directed and recommended by the manufacturer for a complete and operating system.

C. All conductors for the security system shall be as recommended by the manufacturer of the intrusion alarm system. All conductors shall be in conduit and shall be marked and identified, in all junction boxes, terminal cabinets, etc.

D. Supplier shall prepare a specific point-to-point connection diagram with all wiring and raceways shown, that schematically illustrates the exact installation of the system as detailed in these plans and specifications.

E. The system manufacturer's qualified technician shall verify all final connections, to perform diagnostic testing and place particular system into operation. Every device and every system function shall be verified. A special training session shall be conducted to train owner- designated representatives in the proper operation of the system.

END OF SECTION 16750



SECTION 16721 - INTELLIGENT COMMUNICATING FIRE DETECTION SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section of the specification includes the furnishing, installation, connection and testing of the microprocessor controlled, intelligent reporting fire alarm equipment required to form a complete, operative, coordinated system. It shall include, but not be limited to, alarm initiating devices, alarm notification appliances, Fire Alarm Control Panel (FACP), auxiliary control devices, annunciators, and wiring as shown on the drawings and specified herein.

B. The fire alarm system shall comply with requirements of NFPA Standard No. 72 for Remote Station Protected Premises Signaling Systems except as modified and supplemented by this specification. The system field wiring shall be supervised either electrically or by software-directed polling of field devices.

C. The fire alarm system shall comply with requirements of NFPA Standard No. 72 for Local Protected Premises Signaling Systems except as modified and supplemented by this specification. The system field wiring shall be supervised either electrically or by software-directed polling of field devices.

D. The fire alarm system shall be manufactured by an ISO 9001 certified company and meet the requirements of BS EN9001: ANSI/ASQC Q9001-1994.

E. The FACP and peripheral devices shall be manufactured 100% by a single U.S. manufacturer (or division thereof).

F. Underwriters Laboratories Inc. (UL) - USA:

1. No. 38 Manually Actuated Signaling Boxes.
2. No. 50 Cabinets and Boxes.
3. No. 864 Control Units for Fire Protective Signaling Systems.
4. No. 268 Smoke Detectors for Fire Protective Signaling Systems
5. No. 268A Smoke Detectors for Duct Applications.
6. No. 346 Waterflow Indicators for Fire Protective Signaling Systems.
7. No. 464 Audible Signaling Appliances.
8. No. 521 Heat Detectors for Fire Protective Signaling Systems.
9. No. 1971 Visual Notification Appliances.

G. The installing company shall employ NICET (minimum Level II Fire Alarm Technology) technicians on site to guide the final check-out and to ensure the systems integrity.

1.2 SCOPE

A. An intelligent, microprocessor-controlled, fire alarm detection system shall be installed in accordance to the project specifications and drawings.

B. Basic Performance:

1. Alarm, trouble and supervisory signals from all intelligent reporting devices shall be encoded on NFPA Style 4 (Class B), Style 6 (Class A) or Style 7 (Class A) Signaling Line Circuits (SLC).
2. Initiation Device Circuits (IDC) shall be wired Class B (NFPA Style B) or Class A (NFPA Style D) as part of an addressable device connected by the SLC Circuit.

3. Notification Appliance Circuits (NAC) shall be wired Class B (NFPA Style Y) or Class A (NFPA Style Z) as part of an addressable device connected by the SLC Circuit.
4. All circuits shall be power-limited, per UL864 9th edition requirements.
5. A single ground fault or open circuit on the system Signaling Line Circuit shall not cause system malfunction, loss of operating power or the ability to report an alarm when wire NFPA Style 6/7.
6. Alarm signals arriving at the main FACP shall not be lost following a primary power failure or outage of any kind until the alarm signal is processed and recorded.

1.2 BASIC SYSTEM FUNCTIONAL OPERATION

A. When a fire alarm condition is detected and reported by one of the system initiating devices, the following functions shall immediately occur:

1. The system Alarm LED on the FACP shall flash.
2. A local sounder with the control panel shall sound.
3. A backlit 80-character LCD display on the FACP shall indicate all information associated with the fire alarm condition, including the type of alarm point and its location within the protected premises.
4. In response to a fire alarm condition, the system will process all control programming and activate all system outputs (alarm notification appliances and/or relays) associated with the point(s) in alarm.

1.3 SUBMITTALS

A. General:

1. Two copies of all submittals shall be submitted to the Architect/Engineer for review.
2. All references to manufacturer's model numbers and other pertinent information herein is intended to establish minimum standards of performance, function and quality. Equivalent compatible UL-listed equipment from other manufacturers may be substituted for the specified equipment as long as the minimum standards are met.
3. For equipment other than that specified, the contractor shall supply proof that such substitute equipment equals or exceeds the features, functions, performance, and quality of the specified equipment.

B. Shop Drawings:

1. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.
2. Include manufacturer's name(s), model numbers, ratings, power requirements, equipment layout, device arrangement, complete wiring point-to-point diagrams, and conduit layouts.
3. Show annunciator layout, configurations, and terminations.

C. Manuals:

1. Submit simultaneously with the shop drawings, complete operating and maintenance manuals listing the manufacturer's name(s), including technical data sheets.
2. Wiring diagrams shall indicate internal wiring for each device and the interconnections between the items of equipment.
3. Provide a clear and concise description of operation that gives, in detail, the information required to properly operate the equipment and system.

D. Software Modifications:

1. Provide the services of a qualified technician to perform all system software modifications, upgrades or changes. Response time of the technician to the site shall not exceed 4 hours.
2. Provide all hardware, software, programming tools and documentation necessary to modify the fire alarm system on site. Modification includes addition and deletion of devices, circuits, zones and changes to system operation and custom label changes for devices or zones. The system structure and software shall place no limit on the type or extent of software modifications on-site. Modification of software shall not require power-down of the system or loss of system fire protection while modifications are being made.

1.4 GUARANTY

A. ALl work performed and all material and equipment furnished under this contract shall be free from defects and shall remain so for a period of at least one (1) year from the date of acceptance. The full cost of maintenance, labor and materials required to correct any defect during this one year period shall be included in the submittal bid.

1.5 MAINTENANCE

A. Maintenance and testing shall be on a semi-annual schedule or as required by the local AHJ. A preventive maintenance schedule shall be provided by the contractor describing the protocol for preventive maintenance. The schedule shall include:

1. Systematic examination, adjustment and cleaning of all detectors, manual fire alarm stations, control panels, power supplies, relays, waterflow switches and all accessories of the fire alarm system.
2. Each circuit in the fire alarm system shall be tested semiannually.
3. Each smoke detector shall be tested in accordance with the requirements of NFPA 72 (2002 Edition) Chapter 10.

B. As part of the bid/proposal, include a quote for a maintenance contract to provide all maintenance, tests, and repairs described below. Include also a quote for unscheduled maintenance/repairs, including hourly rates for technicians trained on this equipment, and response travel costs for each year of the maintenance period. Submittals that do not identify all post contract maintenance costs will not be accepted. Rates and costs shall be valid for the period of five (5) years after expiration of the guaranty.

1.6 POST CONTRACT EXPANSIONS

A. The contractor shall have the ability to provide parts and labor to expand the system specified, if so requested, for a period of five (5) years from the date of acceptance.

B. As part of the submittal, include a quotation for all parts and material, and all installation and test labor as needed to increase the number of intelligent or addressable devices by ten percent (10%). This quotation shall include intelligent smoke detectors, intelligent heat detectors, addressable manual stations, addressable monitor modules, and addressable control modules equal in number to one tenth of the number required to meet this specification (list actual quantity of each type).

C. The quotation shall include installation, test labor, and labor to reprogram the system for this 10% expansion. If additional FACP hardware is required, include the material and labor necessary to install this hardware.

D. Do not include cost of conduit or wire or the cost to install conduit or wire except for labor to make final connections at the FACP and at each intelligent addressable device. Do not include the cost of conventional peripherals or the cost of initiating devices or notification appliances

connected to the addressable monitor/control modules.

E. Submittals that do not include this estimate of post contract expansion cost will not be accepted.

1.7 APPLICABLE STANDARDS AND SPECIFICATIONS

A. The specifications and standards listed below form a part of this specification. The system shall fully comply with the latest issue of these standards, if applicable.

B. National Fire Protection Association (NFPA) - USA:

1. No. 13 Sprinkler Systems.
2. No. 70 National Electric Code (NEC).
3. No. 72 National Fire Alarm Code.
4. No. 101 Life Safety Code.

C. The system and its components shall be Underwriters Laboratories, Inc. listed under the appropriate UL testing standard as listed herein for fire alarm applications and the installation shall be in compliance with the UL listing.

D. Local and State Building Codes.

E. All requirements of the Authority Having Jurisdiction (AHJ).

1.8 APPROVALS

A. The system shall have proper listing and/or approval from the following nationally recognized agencies:

1. Underwriters Laboratories Inc.
2. ULC Underwriters Laboratories Canada.
3. FM Factory Mutual.
4. MEA Material Equipment Acceptance (NYC).
5. CSFM California State Fire Marshal.

PART 2 - PRODUCTS

2.1 EQUIPMENT AND MATERIAL, GENERAL

A. All equipment and components shall be new, and the manufacturer's current model. The materials, appliances, equipment and devices shall be tested and listed by a nationally recognized approvals agency for use as part of a fire protective signaling system, meeting the National Fire Alarm Code.

B. All equipment and components shall be installed in strict compliance with manufacturers' recommendations. Consult the manufacturer's installation manuals for all wiring diagrams, schematics, physical equipment sizes, etc., before beginning system installation.

C. All equipment shall be attached to walls and ceiling/floor assemblies and shall be held firmly in place (e.g., detectors shall not be supported solely by suspended ceilings). Fasteners and supports shall be adequate to support the required load.

2.2 CONDUIT AND WIRE

A. Conduit:

1. Conduit shall be in accordance with The National Electrical Code (NEC), local and state requirements.
2. All wiring shall be installed in conduit or raceway. Conduit fill shall not exceed 40 percent of interior cross sectional area where three or more cables are contained within a single conduit.
3. Cable must be separated from any open conductors of power, or Class 1 circuits, and shall not be placed in any conduit, junction box or raceway containing these conductors, per NEC Article 760-55.
4. With the exception of telephone connections, wiring for 24-volt DC control, alarm notification, emergency communication and similar power-limited auxiliary functions may be run in the same conduit as initiating and signaling line circuits. All circuits shall be provided with transient suppression devices and the system shall be designed to permit simultaneous operation of all circuits without interference or loss of signals.
5. Conduit shall not enter the fire alarm control panel, or any other remotely mounted control panel equipment or backboxes, except where conduit entry is specified by the FACP manufacturer.
6. Conduit shall be 3/4-inch (19.1 mm) minimum.

B. Wire:

1. All fire alarm system wiring shall be new.
2. Wiring shall be in accordance with local, state and national codes (e.g., NEC Article 760) and as recommended by the manufacturer of the fire alarm system. Number and size of conductors shall be as recommended by the fire alarm system manufacturer, but not less than 18 AWG (1.02 mm) for Initiating Device Circuits and Signaling Line Circuits, and 14 AWG (1.63 mm) for Notification Appliance Circuits.
3. All wire and cable shall be listed and/or approved by a recognized testing agency for use with a protective signaling system.
4. Wire and cable not installed in conduit shall have a fire resistance rating suitable for the installation as indicated in NEC 760 (e.g., FPLR).
5. Wiring used for the multiplex communication circuit (SLC) shall be twisted and support a minimum wiring distance of 10,000 feet. The design of the system shall permit use of IDC and NAC wiring in the same conduit with the SLC communication circuit. Shielded wire shall not be required.
6. All field wiring shall be electrically supervised for open circuit and ground fault.
7. The fire alarm control panel shall be capable of T-tapping Class B (NFPA Style 4) Signaling Line Circuits (SLCs). Systems which do not allow or have restrictions in, for example, the amount of T-taps, length of T-taps etc., are not acceptable.

C. Terminal Boxes, Junction Boxes and Cabinets:

1. All boxes and cabinets shall be UL listed for their use and purpose.

D. The fire alarm control panel shall be connected to a separate dedicated branch circuit, maximum 20 amperes. This circuit shall be labeled at the main power distribution panel as FIRE ALARM. Fire alarm control panel primary power wiring shall be 12 AWG. The control panel cabinet shall be grounded securely to either a cold water pipe or grounding rod. The control panel enclosure shall feature a quick removal chassis to facilitate rapid replacement of the FACP electronics.

1. The FACP shall be capable of coding Notification Appliance Circuits in March Time Code (120 PPM), Temporal (NFPA 72 A-2-2.2.2), and California Code. Main panel notification circuits (NACs 1 & 2) shall also automatically synchronize any of the following manufacturer's notification appliances connected to them: System Sensor, Wheelock, or Gentex with no need for additional synchronization modules.

2.3 MAIN FIRE ALARM CONTROL PANEL

A. The FACP shall be a NOTIFIER NFS-320 and shall contain a microprocessor-based Central Processing Unit (CPU). The CPU shall communicate with and control the following types of equipment used to make up the system: intelligent addressable smoke and thermal (heat) detectors, addressable modules, printer, annunciators, and other system controlled devices.

B. Operator Control

1. Acknowledge Switch:
   a. Activation of the control panel Acknowledge switch in response to new alarms and/or troubles shall silence the local panel piezo electric signal and change the alarm and trouble LEDs from flashing mode to steady-ON mode. If multiple alarm or trouble conditions exist, depression of this switch shall advance the 80-character LCD display to the next alarm or trouble condition.
   b. Depression of the Acknowledge switch shall also silence all remote annunciator piezo sounders.

2. Alarm Silence Switch:
   a. Activation of the alarm silence switch shall cause all programmed alarm notification appliances and relays to return to the normal condition after an alarm condition. The selection of notification circuits and relays that are silenceable by this switch shall be fully field programmable within the confines of all applicable standards. The FACP software shall include silence inhibit and auto-silence timers.

4. Alarm Activate (Drill) Switch:
   a. The Alarm Activate switch shall activate all notification appliance circuits. The drill function shall latch until the panel is silenced or reset.

5. System Reset Switch:
   a. Activation of the System Reset switch shall cause all electronically-latched initiating devices, appliances or software zones, as well as all associated output devices and circuits, to return to their normal condition.

6. Lamp Test:
   a. The Lamp Test switch shall activate all system LEDs and light each segment of the liquid crystal display.

C. System Capacity and General Operation

1. The control panel shall provide, or be capable of, expansion to 300 intelligent/addressable devices.
2. The control panel shall include two Form-C programmable relays which can be used for Alarm, Supervisory, and a fixed Trouble relay rated at a minimum of 2.0 amps @ 30 VDC and 0.5 amps @ 30 VAC . It shall also include two programmable Notification Appliance Circuits (NACs) capable of being wired as Class B (NFPA Style Y) or Class A (NFPA Style Z).
3. The fire alarm control panel shall include an operator interface control and annunciation panel that shall include a backlit Liquid Crystal Display (LCD), individual color-coded system status LEDs, and an alphanumeric keypad for the field programming and control of the fire alarm system.
4. All programming or editing of the existing program in the system shall be achieved without special equipment and without interrupting the alarm monitoring functions of the fire alarm control panel. The system shall be fully programmable, configurable, and expandable in the field without the need for special tools, PROM programmers or PC based programmers. It shall not require replacement of memory ICs to facilitate

programming changes. The control unit will support the ability to upgrade its operating program using FLASH memory technology. The unit shall provide the user with the ability to program from either the included keypad, a standard PS2-style PC keyboard or from a computer running upload/download software.

5. The system shall allow the programming of any input to activate any output or group of outputs. Systems which have limited programming (such as general alarm), have complicated programming (such as a diode matrix), or REQUIRE a laptop personal computer are not considered suitable substitutes.
6. The FACP shall provide the following features:
   a. Drift compensation to extend detector accuracy over life. Drift compensation shall also include a smoothing feature, allowing transient noise signals to be filtered out.
   b. Detector sensitivity test, meeting requirements of NFPA 72, Maintenance alert, with two levels (maintenance alert/maintenance urgent), to warn of excessive smoke detector dirt or dust accumulation.
   c. The ability to display or print system reports.
   d. Alarm Verification.
   e. Positive Alarm Sequence (PAS presignal), meeting NFPA 72 (2002 Edition) 6.8.1.3 requirements.
   f. Rapid manual station reporting.
   g. Non-alarm points for general (non-fire) control.
   h. Periodic detector test, conducted automatically by the software.
   i. Walk test, with a check for two detectors set to same address.
7. The FACP shall be capable of coding Notification Appliance Circuits in March Time Code (120 PPM), Temporal (NFPA 72 A-2-2.2.2), and California Code. Main panel notification circuits (NACs 1 & 2) shall also automatically synchronize and be programmable for any of the following manufacturer's notification appliances connected to them: System Sensor, Wheelock or Gentex with no need for additional synchronization modules.

D. Central Microprocessor:

1. The microprocessor shall be a state-of-the-art, high speed, 16-bit RISC device and it shall communicate with, monitor and control all external interfaces. It shall include an EPROM for system program storage, non-volatile memory for building-specific program storage, and a "watch dog" timer circuit to detect and report microprocessor failure.
2. The microprocessor shall contain and execute all specific actions to be taken in the condition of an alarm. Control programming shall be held in non-volatile programmable memory, and shall not be lost even if system primary and secondary power failure occurs.
3. The microprocessor shall also provide a real-time clock for time annotation of system displays, printer, and history file.
4. A special program check function shall be provided to detect common operator errors.
5. An auto-programming capability (self-learn) shall be provided to quickly identify devices connected on the SLC and make the system operational.
6. For flexibility and to ensure program validity, an optional Windows(TM) based program utility shall be available. This program shall be used to off-line program the system with batch upload/download. This program shall also have a verification utility which scans the program files, identifying possible errors. It shall also have the ability to compare old program files to new ones, identifying differences in the two files to allow complete testing of any system operating changes. This shall be in incompliance with the NFPA 72 requirements for testing after system modification.

E. Display:

1. The display shall provide all the controls and indicators used by the system operator and may also be used to program all system operational parameters.

2. The display shall include status information and custom alphanumeric labels for all intelligent detectors, addressable modules, internal panel circuits, and software zones.
3. The display shall contain an alphanumeric, text-type display and dedicated LEDs for the annunciation of AC POWER, FIRE ALARM, SUPERVISORY, TROUBLE, and ALARM SILENCED conditions.
4. The display keypad shall be part of the standard system and have the capability to command all system functions, entry of any alphabetic or numeric information, and field programming. Two different password levels shall be provided to prevent unauthorized system control or programming.
5. The display shall include the following operator control switches: ACKNOWLEDGE/STEP, ALARM SILENCE, DRILL (alarm activate), and SYSTEM RESET.

F. Voice Evacuation Control Panel

1. The FACP shall be a NOTIFIER NFV-25/50 (Fire Voice 25/50) and shall contain a microprocessor-based Central Processing Unit (CPU). The CPU shall distribute and control emergency voice messages over the speaker circuits.
2. The system shall provide the capability to interface to distributed voice evacuation control panels from the same manufacturer.
3. Shall have as minimum requirements:
   a. Integral 25 Watt, 25 Vrms audio amplifier with optional converter for 70.7-volt systems. The system shall be capable of expansion to 50 watts total via the insertion of an additional 25-watt audio amplifier module into the same cabinet.
   b. Speaker circuit that can be wired both Class A or B.
   c. Integral Digital Message Generator with a memory capacity for up to 60 seconds of messaging. The Digital Message Generator shall be capable of producing five distinct messages (12 seconds each). These messages shall field programmable without the use of additional equipment.
   d. Built in alert tone generators with steady, slow whoop, high/low and chime tone field programmable.
   e. The Voice Control Panel will be capable of detecting and annunciating the following conditions: Loss of Power (AC and DC), System Trouble, Ground Fault, Alarm, Microphone Trouble, Message Generator Trouble, Tone Generator Trouble, and Amplifier Fault.
   f. The Voice Control Panel shall be fully power-limited.
   g. Speaker outputs shall be fully power-limited.
   h. Amplifiers will be supplied power independently to eliminate a short on one circuit from affecting other circuits.
   i. The Voice Control Panel will provide full supervision on both active (alarm or music) and standby conditions.
   j. An optional zone splitter version shall be available that permits splitting speaker circuits into 8 specific zones.
   k. An optional distributed amplifier unit shall be available that permits splitting speaker circuits into up to a total of 24 zones when two distributed amplifiers are combined with the master unit.
4. Speakers:
   a. All speakers shall operate on 25 or 70 VRMS with field selectable output taps from 0.5 to 2.0 Watts.
   b. Speakers in corridors and public spaces shall produce a nominal sound output of 84 dBA at 10 feed (3m).
   c. Frequency response shall be a minimum of 400 HZ to 4000 HZ.
   d. The back of each speaker shall be sealed to protect the speaker cone from damage and dust.

G. Signaling Line Circuit (SLC):

1. The SLC interface shall provide power to and communicate with up to 159 devices of any type including: intelligent detectors (ionization, photoelectric or thermal), addressable pull stations, intelligent modules (monitor or control). Each SLC shall be capable of NFPA 72 Style 4, Style 6, or Style 7 (Class A or B) wiring.
2. The CPU shall receive information from all intelligent detectors to be processed to determine whether normal, alarm or trouble conditions exist for each detector. The software shall automatically compensate for the accumulation of dust in each detector up to allowable limits. The information shall also be used for automatic detector testing and for the determination of detector maintenance conditions.
3. The detector software shall meet NFPA 72 (2002 Edition), Chapter 10 requirements and be certified by UL as a calibrated sensitivity test instrument.

H. Serial Interfaces

1. The system shall provide a means of interfacing to UL Listed Electronic Data Processing (EDP) peripherals using the EIA-232 communications standard.
2. An annunciator RS-485 (ANN-Bus) bus shall be used to connect an UL-Listed 80-column printer anywhere within the 6,000 range of the serial bus connection. The printer shall communicate with the control panel using an RS-485 converter/interface complying with Electrical Industries Association standard EIA-232D. Power to the printer shall be 120 VAC @ 60 Hz. The interface shall contain both a 9-pin serial and standard centronics parallel connector. Either shall be capable of connection to a serial or parallel printer. The bus shall also provide connection to additional addressable modules supporting remote 80 character LCD text annunciators that mimic the standard panel display and controls. Said annunciators shall support remote acknowledge, silence, drill and reset functions and shall be enabled via a keyswitch. The bus shall also provide connection to addressable modules supporting up to 40 LEDs for use with a graphic annunciator.

I. The control panel will have the capability of Reverse Polarity Transmission or connection to a Municipal Box for compliance with applicable NFPA standards.

J. Digital Alarm Communicator Transmitter (DACT). The DACT is an interface for communicating digital information between a fire alarm control panel and a UL-Listed central station:

1. The DACT shall be an integral component of the fire alarm control panel requiring no interconnecting wiring or supervisory circuitry.
2. The DACT shall include connections for dual telephone lines (with voltage detect), per UL/NFPA/FCC requirements. It shall include the ability for split reporting of panel events up to two different telephone numbers.
3. The DACT shall be completely field programmable locally from the control panel keypad or remotely over a phone line using upload/download PC software.
4. The DACT shall be capable of transmitting events in at least 15 different formats. This ensures compatibility with existing and future transmission formats.
5. Communication shall include vital system status such as:
   a. Independent Zone (Alarm, trouble, non-alarm, supervisory).
   b. Independent Addressable Device Status.
   c. AC (Mains) Power Loss.
   d. Low Battery and Earth Fault.
   e. System Off Normal.
   f. 12 and 24-Hour Test Signal.
   g. Abnormal Test Signal (per UL requirements).
   h. EIA-485 Communications Failure.
   i. Phone Line Failure.

K. Enclosures:

1. The control panel shall be housed in a UL-listed cabinet suitable for surface or semi-flush mounting. The cabinet and front shall be corrosion protected, given a rust-resistant prime coat, and manufacturer's standard finish.
2. The back box and door shall be constructed of steel with provisions for electrical conduit connections into the sides and top.
3. The door shall provide a key lock and shall provide for the viewing of all indicators.
4. The cabinet shall accept a chassis containing the PCB and to assist in quick replacement of all the electronics including power supply shall require no more than two bolts to secure the panel to the enclosure back box.
5. The cabinet shall also support a mechanical secured optional dress panel limiting access to the internals of the panel.

L. Field Charging Power Supply: The FCPS is a device designed for use as either a remote 24-volt power supply or as a booster for powering Notification Appliances:

1. The FCPS shall offer up to 8.0 amps (6.0 amps continuous) of regulated 24-volt power. It shall include an integral charger designed to charge 18.0 amp hour batteries.
2. The Field Charging Power Supply shall have two input triggers. The input trigger shall be a Notification Appliance Circuit (from the fire alarm control panel) or a control relay. Four NAC outputs, wired NFPA Style Y or Z, shall be available for connection to the Notification devices.
3. The FCPS shall optionally provide synchronization of all connected strobes or horn strobe combinations when System Sensor, Wheelock, or Gentex devices are installed.
4. The FCPS shall function as a sync follower as well as a sync generator.
5. The FCPS shall include a surface mount backbox.
6. The Field Charging Power Supply shall include the ability to delay the reporting of an AC fail condition per NFPA requirements.
7. The FCPS shall provide 24 VDC regulated and power-limited circuitry per UL 864 9th edition standards.

M. Power Supply:

1. The main power supply for the fire alarm control panel shall provide 3.7 amps of available power for the control panel and peripheral devices.
2. Provisions will be made to allow the audio-visual power to be increased as required by adding modular expansion audio-visual power supplies.
3. Positive-Temperature-Coefficient (PTC) thermistors, circuit breakers, or other over-current protection shall be provided on all power outputs. The power supply shall provide an integral battery charger or may be used with an external battery and charger systems. Battery arrangement may be configured in the field.
4. The main power supply shall continuously monitor all field wires for earth ground conditions.
5. The main power supply shall operate on 120 VAC, 60 Hz, and shall provide all necessary power for the FACP.

N. Programmable Electronic Sounders:

1. Electronic sounders shall operate on 24 VDC nominal.
2. Electronic sounders shall be field programmable without the use of special tools, to provide continuous, or interrupted tones with an output sound level of at least 90 dBA measured at 10 feet from the device.
3. Shall be flush or surface mounted as show on plans.

O. Strobe lights shall meet the requirements of the ADA, UL Standard 1971 and shall meet the following criteria:

1. The maximum pulse duration shall be 2/10 of one second.
2. Strobe intensity shall meet the requirements of UL 1971.
3. The flash rate shall meet the requirements of UL 1971.

P. Audible/Visual Combination Devices:

1. Shall meet the applicable requirements of Section M listed above for audibility.
2. Shall meet the requirements of Section N listed above for visibility.

Q. Manual Fire Alarm Stations:

1. Manual fire alarm stations shall be non-code, non-breakglass type, equipped with key lock so that they may be tested without operating the handle.
2. Stations must be designed such that after an actual activation, they cannot be restored to normal except by key reset.
3. An operated station shall automatically condition itself so as to be visually detected, as operated, at a minimum distance of 100 feet (30.5 m) front or side.
4. Manual stations shall be constructed of high impact Lexan, with operating instructions provided on the cover. The word FIRE shall appear on the manual station in letters one half inch (12.7 mm) in size or larger.

R. Duct Smoke Detectors:

1. Duct smoke detectors shall be either an addressable or 24 VDC type with visual alarm and power indicators, and a reset switch. Each detector shall be installed upon the composite supply/return air ducts(s), with properly sized air sampling tubes.

S. Automatic Conventional Heat Detectors:

1. Automatic heat detectors shall have a combination rate of rise and fixed temperature rated at 135 degrees Fahrenheit (57.2 Celsius) for areas where ambient temperatures do not exceed 100 degrees (37.7 Celsius), and 200 degrees (93.33 Celsius) for areas where the temperature does not exceed 150 degrees (65.5 Celsius).
2. Automatic heat detectors shall be a low profile, ceiling mount type with positive indication of activation.
3. The rate of rise element shall consist of an air chamber, a flexible metal diaphragm, and a factory calibrated, moisture-proof, trouble free vent, and shall operate when the rate of temperature rise exceeds 15 degrees F (9.4 degrees C) per minute.
4. The fixed temperature element shall consist of a fusible alloy retainer and actuator shaft.
5. Automatic heat detectors shall have a smooth ceiling rating of 2500 square feet (762 square meters).

T. Waterflow Indicator:

1. Waterflow Switches shall be an integral, mechanical, non-coded, non-accumulative retard type.
2. Waterflow Switches shall have an alarm transmission delay time which is conveniently adjustable from 0 to 60 seconds. Initial settings shall be 30-45 seconds.
3. All waterflow switches shall come from a single manufacturer and series.
4. Waterflow switches shall be provided and connected under this section but installed by the mechanical contractor.
5. Where possible, locate waterflow switches a minimum of one (1) foot from a fitting which changes the direction of the flow and a minimum of three (3) feet from a valve.

U. Sprinkler and Standpipe Valve Supervisory Switches:

1. Each sprinkler system water supply control valve riser, zone control valve, and standpipe system riser control valve shall be equipped with a supervisory switch. Standpipe hose valves, and test and drain valves shall not be equipped with supervisory switches.
2. PIV (post indicator valve) or main gate valves shall be equipped with a supervisory switch.
3. The switch shall be mounted so as not to interfere with the normal operation of the valve and adjusted to operate within two revolutions toward the closed position of the valve control, or when the stem has moved no more than one-fifth of the distance from its normal position.
4. The supervisory switch shall be contained in a weatherproof aluminum housing, which shall provide a 3/4-inch (19 mm) conduit entrance and incorporate the necessary facilities for attachment to the valves.
5. The switch housing shall be finished in red baked enamel.
6. The entire installed assembly shall be tamper proof and arranged to cause a switch operation if the housing cover is removed, or if the unit is removed from its mounting.
7. Valve supervisory switches shall be provided and connected under this section and installed by mechanical contractor.

V. Specific System Operations:

1. Alarm Verification: Each of the intelligent addressable smoke detectors in the system may be independently programmed for verification of alarm signals. The alarm verification time period shall not exceed 2 minutes.
2. Point Disable: Any addressable device or conventional circuit in the system may be enabled or disabled through the system keypad.
3. Point Read: The system shall be able to display the following point status diagnostic functions:
   a. Device status.
   b. Device type.
   c. Custom device label.
   d. Device zone assignments.
4. System Status Reports: Upon command from an operator of the system, a status report will be generated and printed, listing all system status.
5. System History Recording and Reporting: The fire alarm control panel shall contain a history buffer that will be capable of storing up to 500 events. Each of these activations will be stored and time and date stamped with the actual time of the activation. The contents of the history buffer may be manually reviewed, one event at a time, or printed in its entirety:
   a. The history buffer shall use non-volatile memory. Systems that use volatile memory for history storage are not acceptable substitutes.
6. Automatic Detector Maintenance Alert: The fire alarm control panel shall automatically interrogate each intelligent detector and shall analyze the detector responses over a period of time. If any intelligent detector in the system responds with a reading that is above or below normal limits, then the system will enter the trouble mode, and the particular detector will be annunciated on the system display. This feature shall in no way inhibit the receipt of alarm conditions in the system, nor shall it require any special hardware, special tools or computer expertise to perform.
7. The fire alarm control panel shall include Silent and Audible Walk Test functions - Silent and Audible. It shall include the ability to test initiating device circuits and Notification Appliance Circuits from the field without returning to the panel to reset the system. The operation shall be as follows:
   a. The Silent Walk Test will not sound NACs but will store the Walk Test information in History for later viewing.
   b. Alarming an initiating device shall activate programmed outputs, which are selected to participate in Walk Test.

c. Introducing a trouble into the initiating device shall activate the programmed outputs.
d. Walk Test shall be selectable on a per device/circuit basis. All devices and circuits which are not selected for Walk Test shall continue to provide fire protection and if an alarm is detected, will exit Walk Test and activate all programmed alarm functions.
e. All devices tested in walk test shall be recorded in the history buffer.

8. Waterflow Operation:
   a. An alarm from a waterflow detection device shall activate the appropriate alarm message on the control panel display; turn on all programmed Notification Appliance Circuits and shall not be affected by the Signal Silence switch.
9. Supervisory Operation:
   a.An alarm from a supervisory device shall cause the appropriate indication on the control panel display, li
10. Signal Silence Operation:
    a. The FACP shall have the ability to program each output circuit (notification circuit or relay) to deactivate upon depression of the Signal Silence switch.
11. Non-Alarm Input Operation:
    a. Any addressable initiating device in the system may be used as a non-alarm input to monitor normally open contact type devices. Non-alarm functions are a lower priority than fire alarm initiating devices.

2.4 SYSTEM COMPONENTS

A. Addressable Pull Box (manual station):

1. Addressable pull boxes shall, on command from the control panel, send data to the panel representing the state of the manual switch and the addressable communication module status. They shall use a key operated test-reset lock, and shall be designed so that after actual emergency operation, they cannot be restored to normal use except by the use of a key.
2. All operated stations shall have a positive, visual indication of operation and utilize a key type reset.
3. Manual stations shall be constructed of Lexan with clearly visible operating instructions provided on the cover. The word FIRE shall appear on the front of the stations in raised letters, 1.75 inches (44 mm) or larger.

B. Intelligent Photoelectric Smoke Detector:

1. The detectors shall use the photoelectric (light-scattering) principal to measure smoke density and shall, on command from the control panel, send data to the panel representing the analog level of smoke density.
2. The detectors shall be ceiling-mounted and available in an alternate model with an integral fixed 135-degree heat-sensing element.
3. Each detector shall contain a remote LED output and a built-in test switch.
4. Detector shall be provided on a twist-lock base.
5. It shall be possible to perform a calibrated sensitivity and performance test on the detector without the need for the generation of smoke. The test method shall test all detector circuits.
6. A visual indication of an alarm shall be provided by dual latching Light Emitting Diodes (LEDs), on the detector, which may be seen from ground level over 360 degrees. These LEDs shall periodically flash to indicate that the detector is in communication with the control panel.
7. The detector shall not go into alarm when exposed to air velocities of up to 1500 feet per minute (fpm).
8. The detector screen and cover assembly shall be easily removable for field cleaning of the detector chamber.

9. All field wire connections shall be made to the base through the use of a clamping plate and screw.

C. Intelligent Ionization Smoke Detector:

1. The detectors shall use the dual-chamber ionization principal to measure products of combustion and shall, on command from the control panel, send data to the panel representing the analog level of products of combustion.

D. Intelligent Thermal Detectors:

1. Thermal detectors shall be intelligent addressable devices rated at 135 degrees Fahrenheit (58 degrees Celsius) and have a rate-of-rise element rated at 15 degrees F (9.4 degrees C) per minute. It shall connect via two wires to the fire alarm control panel signaling line circuit.

E. Intelligent Duct Smoke Detector:

1. The smoke detector housing shall accommodate an intelligent photoelectric detector that provides continuous monitoring and alarm verification from the panel.
2. When sufficient smoke is sensed, an alarm signal is initiated at the FACP, and appropriate action taken to change over air handling systems to help prevent the rapid distribution of toxic smoke and fire gases throughout the areas served by the duct system.

F. Addressable Dry Contact Monitor Module:

1. Addressable monitor modules shall be provided to connect one supervised IDC zone of conventional alarm initiating devices (any normally open dry contact device) to one of the fire alarm control panel SLCs.
2. The monitor module shall mount in a 4-inch square (101.6 mm square), 2-1/8 inch (54 mm) deep electrical box.
3. The IDC zone shall be suitable for Style D or Style B operation. An LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.
4. For difficult to reach areas, the monitor module shall be available in a miniature package and shall be no larger than 2-3/4 inch (70 mm) x 1-1/4 inch (31.7 mm) x 1/2 inch (12.7 mm). This version need not include Style D or an LED.

G. Two-Wire Detector Monitoring:

1. Means shall be provided for the monitoring of conventional Initiating Device Circuits populated with 2-wire smoke detectors as well as normally open contact alarm initiating devices (pull stations, heat detectors, etc).
2. Each IDC of conventional devices will be monitored as a distinct address on the polling circuit by an addressable module. The module will supervise the IDC for alarms and circuit integrity (opens).
3. The monitoring module will be compatible, and listed as such, with all devices on the supervised circuit.
4. The IDC zone may be wired for Class A or B (Style D or Style B) operation. An LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.
5. The monitoring module shall be capable of mounting in a 4-inch square (101.6 mm square), 2-1/8 inch (54 mm) deep electrical box or in a surface mount backbox.

G. Addressable Control Relay Module:

2. Addressable control relay modules shall be provided to control the operation of fan shutdown and other auxiliary control functions.
3. The control module shall mount in a standard 4-inch square, 2-1/8 inch deep electrical box, or to a surface mounted backbox.
4. The control relay module will provide two dry contact, Form-C relays. The relay coil shall be magnetically latched to reduce wiring connection requirements, and to insure that 100% of all auxiliary relays may be energized at the same time on the same pair of wires.
5. The control relay module shall be suitable for pilot duty applications and rated for a minimum of 0.6 amps at 30 VDC.

H. Isolator Module:

1. Isolator modules shall be provided to automatically isolate wire-to-wire short circuits on an SLC Style 6 (Class A) or Style 4 (Class B branch). The isolator module shall limit the number of modules or detectors that may be rendered inoperative by a short circuit fault on the SLC loop segment or branch. At least one isolator module shall be provided for each floor or protected zone of the building.
2. If a wire-to-wire short occurs, the isolator module shall automatically open-circuit (disconnect) the SLC. When the short circuit condition is corrected, the isolator module shall automatically reconnect the isolated section.
3. The isolator module shall not require any address setting, and its operations shall be totally automatic. It shall not be necessary to replace or reset an isolator module after its normal operation.
4. The isolator module shall mount in a standard 4-inch (101.6 mm) deep electrical box or in a surface mounted backbox. It shall provide a single LED that shall flash to indicate that the isolator is operational and shall illuminate steadily to indicate that a short circuit condition has been detected and isolated.

J. Alphanumeric LCD Type Annunciator:

1. The alphanumeric display annunciator shall be a supervised, remotely located backlit LCD display containing a minimum of eighty (80) characters for alarm annunciation in clear English text.
2. The LCD annunciator shall display all alarm and trouble conditions in the system.
3. An audible indication of alarm shall be integral to the alphanumeric display.
4. The display shall be UL listed for fire alarm application.
5. It shall be possible to connect up to 8 LCD displays and be capable of wiring distances up to 6,000 feet from the control panel.
6. The annunciator shall connect to a separate, dedicated "terminal mode" EIA-485 interface using two-wire loop connection and 2 wires for power. Each terminal mode LCD display shall mimic the main control panel.

K. Door Holders:

1. Door Holders will be available in 120 VAC and 24 VDC models.
2. 120 VAC models will be transient-protected against surges up to 600 volts.
3. Door holders will be designed for Fail Safe operation (power failure release door to close).

2.5 SYSTEM COMPONENTS - ADDRESSABLE DEVICES

A. Addressable Devices - General:

1. Addressable devices shall employ the simple-to-set decade addressing scheme. Addressable devices which use a binary-coded address setting method, such as a DIP

switch, are not an allowable substitute.

2. Detectors shall be addressable and intelligent, and shall connect with two wires to the fire alarm control panel signaling line circuits.
3. Addressable smoke and thermal (heat) detectors shall provide dual alarm and power/polling LEDs. Both LEDs shall flash under normal conditions, indicating that the detector is operational and in regular communication with the control panel, and both LEDs shall be placed into steady illumination by the control panel, indicating that an alarm condition has been detected. An output connection shall also be provided in the base to connect an external remote alarm LED.
4. Using software in the FACP, detectors shall automatically compensate for dust accumulation and other slow environmental changes that may affect their performance. The detectors shall be listed by UL as meeting the calibrated sensitivity test requirements of NFPA Standard 72, Chapter 10.
5. Detectors shall be ceiling-mount and shall include a separate twist-lock base with tamper proof feature. Base options shall include a base with a built-in (local) sounder rated for a minimum of 85 DBA, a relay base and an isolator base designed for Style 7 applications.
6. Detectors shall provide a test means whereby they will simulate an alarm condition and report that condition to the control panel.
7. Detectors shall also store an internal identifying type code that the control panel shall use to identify the type of device (ION, PHOTO, THERMAL).
8. Detectors shall provide address-setting means using decimal switches.

2.6 BATTERIES

A. Upon loss of Primary (AC) power to the control panel, the batteries shall have sufficient capacity to power the fire alarm system for required standby time (24 or 60 hours) followed by 5 minutes of alarm.

B. The batteries are to be completely maintenance free. No liquids are required. Fluid level checks for refilling, spills, and leakage shall not be required.

C. If necessary to meet standby requirements, external battery/charger systems may be used.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation shall be in accordance with the NEC, NFPA 72, local and state codes, as shown on the drawings, and as recommended by the major equipment manufacturer.

B. All conduit, junction boxes, conduit supports and hangers shall be concealed in finished areas and may be exposed in unfinished areas. Smoke detectors shall not be installed prior to the system programming and test period. If construction is ongoing during this period, measures shall be taken to protect smoke detectors from contamination and physical damage.

C. All fire detection and alarm system devices, control panels and remote annunciators shall be flush mounted when located in finished areas and may be surface mounted when located in unfinished areas.

D. Manual pull stations shall be suitable for surface mounting or semi flush mounting as shown on the plans, and shall be installed not less than 42 inches (1067 mm), nor more than 48 inches (122 mm) above the finished floor.

3.2 TEST

A. The service of a competent, factory-trained engineer or technician authorized by the

manufacturer of the fire alarm equipment shall be provided to technically supervise and participate during all of the adjustments and tests for the system. All testing shall be in accordance with NFPA 72, Chapter 7.

B. Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.

C. Close each sprinkler system flow valve and verify proper supervisory alarm at the FACP.

D. Verify activation of all waterflow switches.

E. Open initiating device circuits and verify that the trouble signal actuates.

F. Open and short signaling line circuits and verify that the trouble signal actuates.

G. Open and short notification appliance circuits and verify that trouble signal actuates.

H. Ground all circuits and verify response of trouble signals.

I. Check presence and audibility of tone at all alarm notification devices.

J. Check installation, supervision, and operation of all intelligent smoke detectors using the walk test.

K. Each of the alarm conditions that the system is required to detect should be introduced on the system. Verify the proper receipt and the proper processing of the signal at the FACP and the correct activation of the control points.

L. When the system is equipped with optional features, the manufacturer's manual shall be consulted to determine the proper testing procedures. This is intended to address such items as verifying controls performed by individually addressed or grouped devices, sensitivity monitoring, verification functionality and similar.

3.3 FINAL INSPECTION

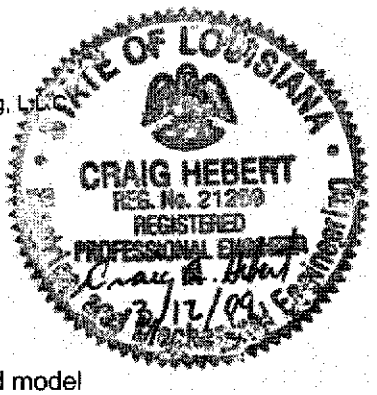
A. At the final inspection, a minimum NICET Level II technician shall demonstrate that the system functions properly in every respect.

3.4 INSTRUCTION

A. Instruction shall be provided as required for operating the system. Hands-on demonstrations of the operation of all system components and the entire system including program changes and functions shall be provided.

B. The contractor or installing dealer shall provide a user manual indicating "Sequence of Operation."

END OF SECTION 16721



SECTION 16726 - INTERCOMMUNICATION SYSTEM

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. All bids shall be based on the equipment as specified herein. The catalog numbers and model designations are that of the RAULAND-BORG CORPORATION. The specifying authority must approve any alternate system.

B. Bidders wishing to submit alternate equipment shall submit to the specifying authority, at least 10 days prior to bid opening, the equipment proposed to provide a precise functional equivalent system to meet specifications. Bidder shall provide adequate information prior to bid date such as specification sheets, working drawings, shop drawings, and a demonstration of the system. Alternate supplier-contractor must also provide a list to include six installations of the identical system proposed which have been in operation for a period of two years.

C. Final approval of the alternate system shall be determined at the time of job completion. Failure to provide the "precise functional equivalent" shall result in the removal of the alternate system at the contractor's expense.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Requirements of the following Division 16 Sections apply to this Section:

1. Basic Electrical Requirements.

2. Basic Electrical Materials and Methods.

1.3 SUMMARY

A. This Section includes Integrated Intercom/Telecommunications System. It includes requirements for Integrated Electronic Communications Network system components including, but not limited to, the following:
1. Administrative Telephones.
2. Ceiling/Wall Mounted Speaker Assemblies.
3. Normal Intercom Call Buttons.
4. Bell/Class Change Signaling System.
5. Public Address/Intercom System.
6. Administrative Digital Readout Wall Display.
7. Controls, Amplifiers, and Terminal Equipment.
8. Power supplies.
9. Wiring.
10. Wall-mounted Paging Horns.
11. Master Clock.
12. Secondary Clocks.
13. Program Sources – Tuner, Cassette
14. Wall Intercom Display

1.4 SYSTEM DESCRIPTION

A. General: Furnish and install all equipment, accessories, and materials in accordance with these specifications and drawings to provide a complete and operating Integrated Intercom/Communications system.

1.5 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections:

1. Submit equipment prints, inter-panel and intra-panel, full electronic wiring diagrams and specification sheets for each item specified herein. Provide a tabulation of the specification clearly comparing the submitted item with the specified item, being able to refer to all written expressed functions and capabilities. Specification Sheets shall be submitted on all items including cable types.

2. Shop drawings, detailing Integrated Electronic Communications Network system including, but not limited to, the following:

   a. Equipment cabinet arrangement.

3. Wiring diagrams, detailing wiring for power, signal, and control, differentiating clearly between manufacturer - installed wiring and field-installed wiring. Identify terminals to facilitate installation, operation and maintenance.

4. Submit wiring diagrams showing typical connections for all equipment.

5. Provide a riser diagram for the system showing in technically accurate detail all connections, interconnections, and all provisions available and made for adaptability of all specified future functions. In addition, riser diagram must include all calculations, charts, and test data necessary to demonstrate that all systems and system components deliver the specified signals, grades, and levels at all required points and locations.

6. Submit a certificate of completion of installation and service training.

1.6 QUALITY ASSURANCE

A. All items of equipment including wire and cable shall be designed by the manufacturer to function as a complete system and shall be accompanied by the manufacturer's complete service notes and drawings detailing all interconnections.

B. The contractor shall be an established communications and electronics contractor that has had and currently maintains a locally run and operated business for at least five years. The contractor shall utilize a duly authorized distributor of the equipment supplied for this project location with full manufacturer's warranty privileges.

C. The contractor shall show satisfactory evidence, upon request, that the supplier maintains a fully equipped service organization capable of furnishing adequate inspection and service to the system. The supplier shall maintain at his facility the necessary spare parts in the proper proportion as recommended by the manufacturer to maintain and service the equipment being supplied.

D. Electrical Component Standard: Provide work complying with applicable requirements of NFPA 70 "National Electrical Code" including, but not limited to:

1. Article 250, Grounding.
2. Article 300, Part A. Wiring Method.
3. Article 310, Conductors for General Wiring.
4. Article 725, Remote Control, Signaling Circuits.
5. Article 800, Communication Systems.

E. EIA Compliance: Comply with the following Electronics Industries Association Standards:

1. Sound Systems, EIA-160.
2. Loudspeakers, Dynamic Magnetic Structures, and Impedance, EIA-299-A.
3. Racks, Panels, and Associated Equipment, EIA-310-A.
4. Amplifiers for Sound Equipment, SE-101-A.
5. Speakers for Sound Equipment, SE-103.

F. The agency providing equipment shall be responsible for providing all specified equipment and mentioned services for all equipment as specified herein. The agency must be a local authorized distributor of all specified equipment for single source of responsibility and shall provide documents proving such. The agency must provide written proof that the agency is adequately staffed with factory-trained technicians for all of the specified equipment. The agency must have established business for and currently be providing all services for the equipment to be provided for a minimum of five (5) years.

G. The contractor shall guarantee availability of local service by factory-trained personnel of all specified equipment from an authorized distributor of all equipment specified under this section. On-the-premise maintenance shall be provided at no cost to the purchaser for a period of one (1) year (parts and labor) from date of acceptance unless damage or failure is caused by misuse, abuse, neglect, or accident. Additionally, all Rauland-Borg manufactured products are covered by a five (5) year (parts only) limited warranty from the date of acceptance. All other manufacturer's intercom equipment shall provide a five- year warranty as part of this bid. (Parts only) The warranty period shall begin on the date of acceptance by the owner/engineer.

H. The contractor shall, at the owner's request, make available a service contract offering continuing factory authorized service of the system after the initial warranty period.

I. The supplier shall visit the sites and familiarize himself with the existing conditions and field requirements prior to submitting a proposal.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver products in factory containers. Store in clean, dry space in original containers. Protect products from fumes and construction traffic. Handle carefully to avoid damage.

1.8 IN-SERVICE TRAINING

A. The contractor shall provide a minimum of eight hours of in-service training with this system. These sessions shall be broken into segments that will facilitate the training of individuals in the operation of this system. Operators Manuals and Users Guides shall be provided at the time of this training.

PART 2 - MANUFACTURERS

2.1 Manufacturers: Subject to compliance with requirements, provide one of the following systems:

1. Telecenter 21 manufactured by Rauland-Borg Corp.

B. The intent of this specification is to establish a standard of quality, function and features. It is the responsibility of the bidder to insure that the proposed product meets or exceeds every standard set forth in these specifications.

C. The functions and features specified are vital to the operation of this facility, therefore, the acceptance of alternate manufacturers does not release contractor from strict compliance with the requirements of this specification.

D. The Contractor for this work shall be held to have read all of the Bidding Requirements, the General Requirements of Division 1, and Contract Proposal Forms; and in the execution of this work, he will be bound by all of the conditions and requirements therein.

E. The contractor shall be responsible for providing a complete functional system including all necessary components whether included in this specification or not.

F. In preparing the bid, the bidder should consider the following:

1. No claim will be made against the owner for any costs incurred by the bidder for any equipment demonstrations which the owner requests.

G. Any prior approval of an alternate system does not automatically exempt the supplier from meeting the intent of these specifications. Failure to comply with the operational and functional intent of these specifications may result in the total removal of the alternate system at the expense of the contractor.

H. Alternate equipment shall be considered if submitted to the specifying authority at least ten (10) days prior to bid date and accompanied with a five –year manufacturer's warranty letter. Submission of an alternate shall contain engineering drawings of the system with specification sheets covering all components of the system as well as all items of Section 1 "SUBMITTALS." The system and equipment drawings and specifications sheet shall meet all items of the specification.

2.2 SYSTEM REQUIREMENTS

A. GENERAL

1. The system shall provide the state of the art in technology for all internal telephone and intercom communications, secondary clock corrections, and bell schedule. The system shall be easy to learn and operate. All standard system programming shall be user friendly to allow the system administrator the ability to easily program system features.

2. Provide complete and satisfactorily operating Integrated Intercom/Communications System as described herein, using materials and equipment of types, sizes, ratings, and performances as indicated. Use materials and equipment that comply with referenced standards and manufacturers' standard design and construction, in accordance with published product information. Coordinate the features of all materials and equipment so they form an integrated system, with components and interconnections matched for optimum performance of specified functions.

3. Features offered by this system shall be implemented and controlled by software programs that can be changed and expanded as customer needs evolve.

4. The system shall allow system monitoring and administration from a local Windows 95/98 PC or remote Windows 95/98 PC via a modem.

5. The system shall be an electronic system consisting of one or two amplified intercom channels, (classroom) speakers, call switches, and/or telephones, digital readout for display of call origination, and solid-state logic and sensing.

6. Ability to provide a multiple zone program distribution, which is not interrupted by intercom communications.

7. The system shall lend itself to expansion by simple addition of modules.

8. The central switching system shall provide for switching of the intercom talk path to a telephone mode, during the course of a call.

9. Two-way telephonic communication capability from any classroom station to any administrative phone.

10. Two-way communication between any telephone and any room speaker.

11. Room speakers and call switches shall be programmable and may be assigned any three, four or five digit number. Any room number may be reassigned at any time, and it shall not be dependent on wiring or circuit numbers.

12. Sixteen (16) separate paging zones shall be provided; each location shall be programmed in software to belong to any combination of software zones.

13. Each dialing administrative telephone in the system shall be programmable for the following options:
    a. Allow zone paging.
    b. Allow All-Page announcements.
    c. Allow Executive Override.
    d. Allow Emergency paging.
    e. Allow activation of Time Zone tones.
    f. Set the priority level and target display of "normal" calls.
    g. Set the priority level and target display of "emergency" calls.
    h. Assignment of architectural number.
    i. Class of Service.
    j. Assignment of associated speaker to paging zone.
    k. Automatic Call-Back-Busy.
    l. Call Forward-No Answer.
    m. Call Forward-Busy.
    n. Allow activation of security monitoring functions on a per room and per zone basis.

14. Amplified two-way voice communication shall be available from any dial phone in the system, through any speaker in the system. This shall allow hands-free communication to any classroom or any individual loudspeaker unit. A programmable pre-announce tone shall sound immediately before the intercom path is opened and a supervisory tone shall continue to sound at regular intervals when speaker monitoring is active.

15. The administrative phones shall be located in the office and where indicated on the plans; these phones instruments shall be used for public and inter-school communication.

16. The system shall allow room or area security monitoring features. This will include the ability to support motion detectors or normally open alarm inputs.

2.3 EQUIPMENT AND MATERIALS

A. CENTRAL CONTROLLER UNIT

1. The Integrated Electronic Communications Network shall have the following capabilities:

   a. Facilities for multiple operations simultaneously without interference with an established pattern of priorities for all administrator/classroom communication capabilities.

   b. Facilities for centralized attendant answering.

   c. The system shall provide Personal Identification Numbers for selected administrators. By dialing their PIN at any system telephone, the administrator shall have access to the same intercom/paging capabilities assigned to their office telephone, regardless of the restrictions on the phone they are currently using.

   d. Provide multiple attendant positions for answering outside lines and internal intercom calls.

   e. Facilities for the central control unit to store information and give reports on features, system activity, etc. upon request either on site or remotely.

   f. Facilities for automatically sounding a warning tone signal over any loudspeaker selected for two-way communications to alert the station attendant (classroom teacher) to the call and prevent unauthorized monitoring.

   g. Facilities for access to any single loudspeaker unit, zone loudspeaker unit, or all loudspeaker units. The warning tone signal shall sound as soon as the station is selected and shall be automatically repeated at regular intervals for the duration of the call if the voice circuit is not activated.

   h. Direct Dialing, two-way amplified voice intercom between all locations equipped with administrative telephones and staff station speakers without the use of a press-to-talk or talk-listen switch.

   i. The Central Controller Unit shall provide an RS-232 port for the connection of on-site or off-site diagnostics by distributor or factory-trained personnel. This port shall be usable for the programming and saving of all programmed data for each system with the utilization of an on-site or off-site computer. This port shall provide the capability of logging of various activities within the system.

   j. Facilities for executive override permitting an assigned telephone to "override" on-going intercom conversation(s) in the system.

   k. Facilities for the instantaneous distribution of emergency announcements simultaneously, by a single button access, to all locations equipped with speakers. Emergency announcements originating from any assigned administrative telephone shall have priority over all regular system functions.

   l. Facilities for the distribution of alarm signals to all areas equipped with speakers by single button access. Up to nine (9) separate distinct alarm signals shall be provided. Each of the distinct alarm signals can be activated by a designated single button.

   m. Capability for assigning speaker locations to any one or more of the sixteen (16) zones for zone paging, up to sixteen (16) zones for program distribution, eight (8) zones for class change "bells", and up to eight (8) security zones. All of these zones may be configured to be independent of the other zones.

n. Facilities for the origination of both "normal" and "emergency" calls from any staff location. Calls may originate from either a separate call switch or by going off hook on the Staff Phone.

o. It shall be possible to review all calls stored in memory in the order received.

p. Facilities for answering calls registered in the digital read-out display merely by pressing a single response button. This capability shall not prevent other calls from being placed or answered by dialing their numbers.

q. Facilities to cancel all staff station originated calls from any administrative telephone.

r. Facilities for assigning or changing classroom numbers by architectural or any desired numbering system; three-digit, four-digit, or five-digit numbers may be assigned.

s. Facilities for multiple loudspeaker or telephone conversations to take place and not prevent announcements, educational, or music programs from being distributed to other areas of the building.

t. Facilities to automatically send incoming calls to an alternate phone or if they remain unanswered for a predetermined amount of time.

u. A facility to notify a user that the intercom path called earlier is now available. If a busy signal is obtained, user shall dial callback feature code and hang up. System shall automatically call back user when intercom path is available and complete an intercom call to speaker.

v. Facilities for universal wiring for all data network, telephones, intercom speakers, and call switches using category 5 cable. Systems requiring a custom cable plant dedicated to just the intercom system will not be acceptable.

w. Facilities for single button access to allow page announcements into speaker zones without interrupting others performing simultaneous functions.

x. Facilities to page one or more area-wide pocket pagers when a call is placed of a specific call priority or all call priorities. The pocket pager will display the calling room number and a numeric call priority.

y. Facilities to automatically alter a call switch's class of service by time of day and day of week as directed by the owner.

z. It shall be possible to initiate Class of Service changes either manually or automatically on a per station basis using internal clock set.

aa. A minimum of four independent program memory sets shall be provided.

bb. Choice of time of service change and active memory set selected shall be completely programmable.

cc. Class of Service Changes shall be programmable by time of day and day of week.

dd. A minimum of 64 unique classes of service shall be available.

ee. Capability for assigning speaker locations to any one or more of the zones for zone paging or time signal reception; this assignment to be a programmable function.

ff. Time signal tones shall be generated on a manual or automatic basis.

gg. Emergency tones shall be distributed from designated Administrative Telephones.

hh. Power amplifiers shall meet all specifications exactly as specified herein, including power capacity and count.

2.4 ADMINISTRATIVE TELEPHONE

A. Administrative Telephones indicated on the drawings shall provide functions as scheduled below:

1. One button dialing of most commonly dialed number or numbers.

2. Facilities for multiple operations simultaneously without interference with an established pattern of priorities for all administrator/classroom communication capabilities.

3. Complete station software assignment including class of service, speed call numbers, and any other features assigned without any wiring changes being required.

4. Facilities to permit the distribution throughout the facility of emergency announcements, all-page announcements, zone-page announcements and emergency/evacuation alert if authorized through class of service.

5. Facilities to enable use of features without the use of "hook switching".

6. Facilities for 2 lines, 48-character LCD module to display room number dialed, room station call, program distribution, and paging zones.

7. Facilities for receiving staff station and/or emergency calls with single button response.

8. Provide saved number redial function.

2.5 NORMAL CALL SWITCH

A. Normal Call Switches indicated on the drawings shall provide functions as scheduled below:

1. Provide one (1) "Normal" call switch that shall activate a distinctive "NORM" level call from single button activation. Button shall be clearly marked "NORM" and shall route call to any one or more Administrative Telephones and/or Displays for quick and easy response from an Administrative Telephone. In accordance with the Americans with Disabilities Act (ADA), the "Normal" call will provide a steady call assurance LED confirming that the call has been placed in the system.

2.6 TIME PROGRAMMING

A. The master time controller shall provide the following functions:

1. Non-volatile memory capacity for storing 550 events and up to 100 Calendar dates for schedule changes.

2. Ability to review, edit and delete events via a Windows 95/98 PC running the configuration program.

3. Review events from any entered time of day.

4. Events shall be programmable to any or all of (8) zone circuits.

5. Selection of any of (8) schedules to allow flexibility due to seasonal changes or special events.

6. Fully automatic Calendar execution.

7. User programmable Automatic Daylight Savings Time Change.

8. Programmable Music-on-Class-Change. This feature shall be programmable from 1 to 3600 seconds (60 minutes).

9. Separate bell-tone selection and separate bell duration for each event.

10. Latched operation of zones to control lighting or other devices.

11. Interface with most types of secondary slave clocks whether synchronous wired or electronic.

12. User-programmable, custom, slave clock correction. Output relays rated at 5 amperes shall be provided on all zone circuits as necessary.

13. Lithium battery will provide not less than 5 years battery back up for timekeeping function.

B. DATA LOGGING

1. System-wide events. The System Log shall contain all events that occurred in the system for which event logging has been enabled to diagnose or document system usage.

2. Schedule parameters. Shows for each day-of-the-week the times-of-day when system configuration modes change.

3. System logging. The System Log Dump report shall list all events that occurred in the system for which event logging has been enabled to diagnose or document system usage.

4. System shall be self-monitoring. System shall include a background process dedicated to self-monitoring.

C. ACCESSORIES

1. Outdoor Horns
   a. Reentrant type.
   b. Frequency Response: 375 to 14,000 Hz.
   c. Power Handling: 15 Watts, 30-Watts Peak.
   d. Variable screw taps, 25 V transformer.
   e. Sound Pressure Level: 110 dB at 1 meter with 1-watt input.
   f. Mounting: Adjustable, horizontal, and vertical.
   g. Rauland Model 3601.

2. Ceiling mounted/ Classroom Station Loudspeakers
   a. 8" Cone.
   b. Frequency Response: 65 to 17,000 Cycles.
   c. Power Rated: 8 Watts.

d. Magnet: 5 Ounce.
e. Axial Sensitivity: 93 dB at 4 feet with 1-watt input.
f. 25-watt variable tap transformer.
g. Rauland Model USO188.

3. All speaker housings for recessed wall mounting.
   a. Classroom stations shall be Rauland ACC1003 grill with Rauland ACC1112 Backbox.
   b. All ceiling-mounted speakers shall be provided with Rauland Model #BAFKIT Ceiling mount complete assembly.
   c. All ceiling-mounted speakers shall be a Rauland #BAFTILE which is comprised of a lay in baffle, 8 inch speaker with a transformer, and a Rauland ACC1101 backbox.

D. EQUIPMENT RACKS

1. Equipment racks shall be located in a climate-controlled area/room as shown on drawings. Equipment racks shall be a minimum: 42 inches high.

   a. Self-contained, specifically engineered racks with provisions for all present and future components as described and recommended by the manufacturer within this specification.

   b. Racks shall be accessible from front and rear.

   c. All program, zone, and time circuitry, data, linkage, power, telecommunications components, and circuitry to be located in racks configured as approved by the St.Tammany Parish School Board.

E. LIGHTING PROTECTION

1. Lightning protection shall be provided and installed for the intercom system system will require each classroom station, outdoor horns, intercom phones etc. shall be protected. (6) EDCO gas tube punch blocks and a Copper grounding rod to be installed in the ground.

F. WALL DISPLAY

1. Wall display shall be a large .44" bright vacuum fluorescent readout, built tone alert, 16 character display, dimensions 9-11/16" wide X 4 1/8" high. Display shall be in the office and will require a standard 5 gang backbox with a minimum depth of 2.5" Rauland TCMQC provide (1) with a 1085-1212 display

G. SCOPE OF WORK

1. Scope of work is to provide and install a new school intercommunication system with all new classroom speaker stations, new wiring, hallway speakers, outdoor horns, staff phones, wall display, LCD displays, new intercom system that will provide for a minimum of 36 stations and can be expanded for the future to meet or exceed 356 total classrooms. All systems submitted for approval must show all cut sheets and will require a letter from the manufacturer that they are the authorized distributor and will provide a five-year equipment warranty and one year labor warranty on there intercommunication products.

PART 3 - EXECUTION

3.1 GENERAL

A. Install system in accordance with NFPA 70 and other applicable codes. Install equipment in accordance with manufacturer's written instructions.

B. Wiring Methods:

1. Install wiring in raceway except within consoles, desks, and counters, and except in accessible ceiling spaces, and in gypsum board partitions, where cable-wiring method may be used. Use UL listed plenum cable in environmental air spaces including plenum ceilings. Conceal wiring except in unfinished spaces.

C. Impedance and Level Matching:

1. Carefully match input and output impedance's and signal levels at signal interfaces. Provide matching networks where required.

D. Control Circuit Wiring:

1. Install control circuits in accordance with NFPA 70 and as indicated. Provide number of conductors as recommended by system manufacturer to provide control functions indicated or specified.

2. The contractor shall mount a main distribution frame behind the Integrated Electronic Communications Network console. All wires shall be laid down on terminal punch blocks and identified by the actual room location it serves. All the communications points shall be wired into this main distribution frame, laid down in sequence, and identified by which line it is on and the point position it serves.

3. All housings are to be located as specified and shown on drawings.

4. Make installation in strict accordance with approved manufacturer's drawings and instructions.

5. The contractor shall provide necessary transient protection on the AC power feed, all station lines leaving or entering the building, and all central office trunks. All protection shall be as recommended by the equipment supplier and referenced to earth ground.

E. Wiring Within Enclosures:

1. Provide adequate length of conductors. Bundle, lace, and train the conductors to terminal points with no excess. Provide and use lacing bars.

2. Provide physical isolation from each other for speaker-microphone, line-level, speaker-level, and power wiring. Run in separate raceways, or where exposed or in same enclosure, provide 12 inch minimum separation between conductors to speaker-microphones and adjacent parallel power and telephone wiring. Provide physical separation as recommended by equipment manufacturer for other Integrated Electronic Communications Network system conductors.

F. Splices, Taps, and Terminations:

1. Make splices, taps and terminations on numbered terminal punch blocks in junction, pull, and outlet boxes, terminal cabinets and equipment enclosures.

2. Identification of Conductors and Cables:

3. Use color coding of conductors and apply wire and cable marking tape to designate wires and cables so all media are identified in coordination with system wiring diagrams.

4. Weatherproofing:

5. Provide weatherproof enclosures for items to be mounted outdoors or exposed to weather.

G. Repairs

1. Wherever walls, ceilings, floors, or other building finishes are cut for installation, repair, restore, and refinish to original appearance.

3.2 GROUNDING

A. The contractor shall provide all necessary transient protection on the AC power feed and on all station lines leaving or entering the building.

B. The contractor shall note in his system drawings, the type and location of these protection devices as well as all wiring information.

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Services:

1. Provide services of a duly factory authorized service representative for this project location to supervise the field assembly and connection of components and the pre-testing, testing, and adjustment of the system.

B. Inspection:

1. Make observations to verify that units and controls are properly labeled, and interconnecting wires and terminals are identified. Provide a list of final tap settings of paging speaker line matching transformers.

C. Testing:

1. Rectify deficiencies indicated by tests and completely re-test work affected by such deficiencies at Contractor's expense. Verify by the system test that the total system meets the Specifications and complies with applicable standards.

3.4 COMMISSIONING

A. Train Owner's maintenance personnel in the procedures and schedules involved in operating, troubleshooting, servicing, and preventative maintenance of the system. Provide a minimum of 8 hours training. Operators Manuals and Users Guides shall be provided at the time of this training.

B. Schedule training with Owner through the Architect, with at least seven days advance notice.

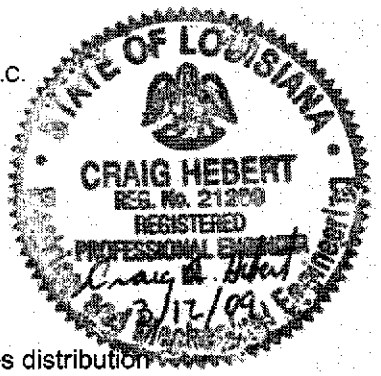
3.5 OCCUPANCY ADJUSTMENTS

A. When requested by the School Board within one year of date of Substantial Completion, provide on-site assistance in adjusting sound levels, resetting matching transformer taps, and adjusting controls to suit actual occupied conditions. Provide up to two visits to the site for this purpose.

3.6 CLEANING AND PROTECTION

A. Prior to final acceptance, clean system components and protect from damage and deterioration.

END OF SECTION 16726



SECTION 16741 – DATA NETWORK DISTRIBUTION SYSTEM

PART 1 - GENERAL

1.1 GENERAL SPECIFICATIONS

A. This document establishes the general specifications for a "universal" premises distribution system that will support virtually industry standard data communications.

1.2 GENERAL CHARACTERISTICS OF CABLE DESIGN

A. This document describes requirements for a cabling system in compliance with EIA/TIA 568B.1 standards. All components that are proposed must be certified to be compliant with these standards. The horizontal cabling system will be Category 6 for data, plenum rated, thermo-plastic, copper cable and associated connectors.

1.3 WARRANTY

A. The complete data network distribution system installed under this project shall be warranted for three years by the installing contractor.

PART 2 - DISTRIBUTION SYSTEM REQUIREMENTS

2.1 INTRODUCTION

A. This scope of work includes the provisioning, installation and testing of cable, wire, and miscellaneous hardware according to the applicable design rules of associated standards.

B. Media Types
   1. The media used for transmission to workstation outlets is as follows:
      (a) Category 6 unshielded twisted 4 pair copper wire (24 AWG) FEP insulated, plenum rated data cable terminated on both ends.
      (b) Any cables installed in underground raceways shall be specifically listed for installation in wet locations and shall be jelly filled.
   2. The media used for transmission between buildings and distances in excess off 250 feet is as follows:
      (a) Multimode, 6 strand, 62.5/125 Micro Meter Fiber.
      (b) Provide an auxiliary pull cord installed with each fiber cable in conduit for future use.

2.2 Equipment Rooms/Satellite Closets

A. Cross-Connect Specifications
   1. The cross-connect hardware must offer design flexibility to allow the system to expand. Unless otherwise specified, bids should be based on the use of Category 6 patch panels with RJ45 jacks and wires terminated in accordance with the ½-inch rule of EIA 568B. All cables will be terminated in Category 6 patch panels fully equipped with horizontal and vertical wire management. Wire management is required between each patch panel.
   2. Each fiber strand shall be terminated at each end into an LIU using ST connectors.

B. Cross-Connect Administration
   1. The distribution system must allow for administration of the communication system via the cross-connect and patch panel configuration, there by providing easy station and terminal rearrangements. Document each wire pull and cross connect along with test data in written and electronic formats prior to acceptance of the cabling system.

C. Cross-Connect Specifications
1. The termination hardware will be located on a 19"x38" rack in the Electrical Equipment Room. The configuration of the patch panel should be in an arrangement that minimizes patch cord lengths. Provide one (1) meter patch cord for each wired patch panel port. Provide one (1) three (3) meter patch cord for each fiber pair installed with ST to MTRJ connector configuration.

2.3 ELECTRICAL REQUIREMENTS

A. All wiring that is exposed to potential electrical hazardous voltages and currents must be protected with the appropriate heat coils and sneak fuses as prescribed in the appropriate electrical code for Louisiana and /or National Electrical code (NEC) Article 250 and Article 800.

2.4 HORIZONTAL SUBSYSTEM

A. Information Outlets:
1. Information Outlet Definition
(a) The information outlet (jack) is defined as Category 6, 8- pin modular jack or connecting block, terminating 4 pair of 24 AWG unshielded, twisted copper wire, which must meet the requirements described EIA/TIA 568-B.1-2000, Category 6. The jack shall be designed with an integral locking mechanism, which, upon insertion of a modular plug, provides maximum pullout strength. The outlets proposed must have the ability to be color-coded by use of a Bizel or the outlet itself being color-coded.

B. The 4-pair wire runs from each work location to the nearest satellite closet shall utilize provided stub up conduits. Be supported by J hooks every 4 feet if not in conduit.

C. Horizontal wiring requirements:
1. From each jack location there shall be two sheaths of category 6 (4-pair, plenum) inside wiring cable to the patch panel.

2.5 CABLE PROTECTION

2. Unless otherwise specified, all cable requiring electrical protection shall be installed with gas tube or solid state protection devices at both ends as prescribed by the appropriate regulations or electrical code for the service areas.

PART 3 - EXECUTION

3.1 TEST/ACCEPTANCE CRITERIA

A. Testing

1. Test each installed copper cable in accordance with TSB 67 to include basic link test and all level two tests. Submit hard copy report of test results.

2. Test each fiber strand in one direction at 850 NM or 1300 NM.

3. Replace any cable which does not pass the acceptance test and re-test.

4. Provide hard copy of final test results in close out documents.

B. Labeling

1. Label each end of each cable with machine printed self adhesive labels.

END OF SECTION 16741

SECTION 16875 - TRANSIENT VOLTAGE SURGE SUPPRESSOR

PART 1 - GENERAL

1.1 APPLICABLE STANDARDS AND TESTING

A. Underwriters Laboratories 1449 - (UL 1449 2nd edition is the current safety standard for Transient Voltage Surge Suppressors).

B. Underwriters Laboratories 1283 - (UL 1283 listed as an electromagnetic interference filter that provides noise attenuation).

C. Underwriters Laboratories 67 - (UL 67 listing for internal panelboard TVSS).

D. Canadian Standards Association (CSA).

E. National Electrical Code 2002 - (NEC Article 285 TVSS Installation practice/NEC Article 250.56 Grounding).

F. NFPA-78 and CSA - (National Fire Protection Association and Canadian Standards Associations).

G. ISO 9001:2000 - Quality standard.

H. Military Standards (MIL-STD 220A).

I. IEEE C62.41.1 and C62.41.2 - 2002 - (System shall be designed to meet American National Standards Institute/Institute of Electrical and Electronic Engineering Inc. C62.41).

J. IEEE C62.45 2002. - (System shall be tested to meet the C62.45).

K. Category A & B - (0.5 mSEC x 100 kHz Ring Wave) .

L. Category B3 Biwave - (8 x 20 mSEC at 3,000 Amperes and 1.2 x 50 mSEC at 6,000 Volts).

M. Category C3 Biwave - (8 x 20 mSEC at 10,000 Amperes and 1.2 x 50 mSEC at 20,000 Volts)

N. The fusing elements must be capable of allowing the suppressor's rated single impulse current to pass through the suppressor at least one time without failure. The system shall be tested to 1,000 sequential ANSI/IEEE C62.41.1 and C62.41.2 Category C3 combination wave transients. The Category C3 combination wave is defined as a 1.2 x 50 microsecond wave at 20,000 volt open circuit voltage waveform and 8 x 20 microsecond wave at 10,000 ampere short circuit current waveform. In addition, the system components shall be tested repetitively 1,000 times testing based on an IEEE C62.33 (MOV test) and C62.35 (SAD test) without failure or degradation exceeding ±10%.

O. CBEMA (ITIC) and IEC - (Computer Business Equipment Manufacturers Association or Information Technology Industry Council and International Electrotechnical Commission define clamping voltage tolerance guidelines for sensitive equipment).

1.2 SUBMITTALS

A. Must have fifteen day prior approval to bid on project. Request for submittal must be in writing with the following items.

B. Drawings: Electrical and mechanical drawings shall be provided by the manufacturer which show unit dimensions, weights, mounting provisions, connection notes, wire size and wiring diagram.

C. Equipment Manual: The manufacturer shall furnish an installation manual with installation notes, start-up and operating instructions for the specified system. Installation instructions shall clearly state whether the system requires an external overcurrent device to maintain the system's UL 1449 listing.

D. National Electrical Code (NEC) 285 - Installation requirements for TVSS.

E. Section 285.2, TVSS must limit transient voltage by diverting or limiting surge current; it also should prevent continued flow of follow current while remaining capable of repeating these functions. TVSS that utilize fuses must have repetitive surge capability that can survive its surge rating and meet UL 1449.

F. Section 285.6, TVSS shall be marked with a short circuit current rating and shall not be installed at a point on the system (ex. service, distribution or branch panels) where the available fault current (AIC rating) is in excess of that rating.

G. UL 1449 stipulation for fused TVSS - The manufacturer's authorized representative is required to submit the following:

1. Certify that the TVSS system is UL 1449 listed (UL Card).
2. Indicate the type of internal or external fusing that is incorporated in the TVSS system and what impact the fusing has on the performance of the device with respect to surge capacity and clamping levels.

B. CBEMA (ITIC) & IEC - SVRs must meet voltage tolerance guidelines:

1. SVR clamp levels for wye and single phase (L-N, L-G and N-G):400-600V for 120V systems, 800-1200V for 277V systems and 1200-1500V for 347V systems
2. SVR clamp levels for delta circuits (L-L and L-G):1000-1200V for 240V systems, 1500-1800V for 480V systems and 1800-2000V for 600V systems

PART 2 - PRODUCTS

2.1 SERVICE ENTRANCE/SWITCHBOARD/SWITCHGEAR

A. Acceptable Manufacturers and Models:

1. Current Technology.
2. LEA International Inc.
3. Liebert
4. Or approved equal.

B. Equipment shall be a multi-stage parallel protector rated for 480 VAC, 3 PHASE, 4 WIRE, plus ground. The equipment's minimum surge current capacity shall be 250 kA per phase (L-N plus L-G) and 250 kA per mode (L-N, L-G, L-L and N-G).

C. The system protection modules shall contain a technology that utilizes a symmetrical array of balanced metal oxide varistors (MOV). Each MOV will be individually coordinated to pass UL 1449.

D. All primary transient paths shall utilize copper wire, aluminum bus bar and lugs of equivalent capacity to provide equal impedance interconnection between phases. No plug-in module or components shall be used in surge carrying paths.

E. Each protection module shall have a visual indicator that signifies that the protection circuitry is on line. The unit shall not be taken off line to verify integrity of system. Redundant status indicators shall be mounted on the front of the door that monitors the system protection circuitry.

F. The system shall be modular with field replaceable modules. Modular units shall contain a minimum of one module per phase.

G. Each protection module shall have a capacitive filtering system connected in each Line to Neutral (L®N)(Wye) mode or Line to Line (L®L)(Delta) mode to provide EMI/RFI noise attenuation (UL 1283).

H. Protection modes: The TVSS shall provide Line to Neutral (L®N)(Wye), Line to Ground (L®G)(Wye or Delta), Line to Line (L®L)(Delta) and Neutral to Ground (N®G)(Wye) protection.

I. Service Conditions: Rate surge protective device for continuous operation under the following conditions, unless otherwise indicated:
1. MCOV: Maximum Continuous Operating Voltage of 125% or greater.
2. Operating Temperature: 30 to 120 degrees F.
3. Humidity: 0 to 85 percent, noncondensing.
4. Altitude: Less than 20,000 feet above sea level.

J. Equipment shall provide the following monitoring features: digital surge counter, switch and disconnect switch. Equipment shall utilize a NEMA 12 enclosure.

2.2 BRANCH PANEL PROTECTION

A. Acceptable Manufacturers and Models:

1. Current Technology.
2. LEA International Inc.
3. Liebert.
4. Or approved equal.

B. Device shall meet all specification requirements in section 2.1 except as follows:

1. Equipment shall be a multi-stage parallel protector rated for 480 VAC, 3 PHASE, 4 WIRE, plus ground. The equipment's minimum surge current capacity shall be 150 kA per phase (L-N plus L-G) and 150 kA per mode (L-N, L-G, L-L and N-G).
2. The system protection modules shall contain a technology that utilizes a symmetrical array of balanced metal oxide varistors (MOV). Each MOV will be individually coordinated to pass UL 1449.

3. Equipment shall provide the following monitoring features: digital surge counter and disconnect switch. Equipment shall utilize a NEMA 12 enclosure.

PART 3 - EXECUTION

3.1 INSTALLATION

A. The specified service entrance/switchboard/switchgear system shall be installed with the shortest lead length possible not to exceed five (5') electrical feet from the power conductor(s) it is protecting, must have a grounding of 25 Ohms (NEC Article 250.56) or less and shall avoid any unnecessary or sharp bends. Utilize a 3 pole 60 amp breaker for connection means.

B. The specified branch panelboard system shall be installed with the shortest lead length possible not to exceed a foot and half (1.5') electrical feet from the power conductor(s) it is protecting, must have a grounding of 25 Ohms (NEC Article 250.56) or less and shall avoid any unnecessary or sharp bends.

3.2 WARRANTY AND QUALITY ASSURANCE

A. Manufacturer shall provide a product warranty for a period of not less than five (5) years from date of installation. Warranty shall cover unlimited replacement of TVSS modules during the warranty period. Those firms responding to this specification shall provide proof that they have been regularly engaged in the design, manufacturing and testing of TVSS for not less than twenty (25) years. Utilize a 3 pole 60 amp breaker for connection means.

END OF SECTION 16875

GEOTECHNICAL REPORT

REPORT OF
GEOTECHNICAL INVESTIGATION

ST. TAMMANY PARISH SCHOOL BOARD
HENRY MAYFIELD ELEMENTARY SCHOOL
SLIDELL (ST. TAMMANY PARISH), LA

FOR

ST. TAMMANY PARISH SCHOOL BOARD
COVINGTON, LOUISIANA

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American Concrete Institute
American Society for Testing and Materials
Florida Institute of Consulting Engineers

Ardaman & Associates, Inc.
Formerly STE
Geotechnical, Environmental and
Materials Consultants

5 December 2008

St. Tammany Parish School Board
321 N. Theard St.
Covington, LA 70433

Attn: Ms. Cameron Tipton
PN: (985) 892-2276
FN: (985) 898-3271

Re: Geotechnical Investigation Report
St. Tammany Parish School Board
Henry Mayfield Elementary School
Slidell (St. Tammany Parish), Louisiana
AAI File: 08-L3235

Dear Cameron,

Transmitted are three (3) copies (two bound and one unbound) of our engineering report covering a geotechnical investigation for the subject project. Our findings, together with the analyses and conclusions based on them, are submitted in the attached report.

Thank you for asking us to perform these services. It has been a pleasure working with you on this project and we look forward to serving you again in the future.

Sincerely,
ARDAMAN AND ASSOCIATES, INC.

CHAD M. POCHE, P.E.
Vice President/Branch Manager

STATE OF LOUISIANA
CHAD M. POCHE
License No. 27597
PROFESSIONAL ENGINEER
IN
CIVIL ENGINEERING

(2) bound copies and (1) unbound copy

JACINTA M. GISCLAIR, E.I.
For Assistant Project Engineer

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TABLE OF CONTENTS

		PAGE
1.0	INTRODUCTION AND LIMITATIONS	1
2.0	SCOPE	1
3.0	FIELD AND LABORATORY PROCEDURES	1
4.0	SITE CONDITIONS	2
4.1	Location and Topography	2
4.2	Geology	2
4.3	Soil Conditions	2
4.4	Ground Water	3
5.0	PROJECT CONSIDERATIONS	3
5.1	Furnished Information	3
5.2	Foundation Recommendations	3
6.0	FILL PLACEMENT EFFECTS	4
6.1	Fill Settlement	4
6.2	Time Rate	4
6.3	Monitoring	4
7.0	SHALLOW FOUNDATIONS	5
7.1	Bearing Capacity	5
7.2	Settlements	5
7.3	Inspection and Protection of the Bearing Surface	6
8.0	FLOOR SLABS	6
8.1	Modulus of Subgrade Reaction	6
9.0	EARTHWORK CONSIDERATIONS	6
9.1	Site Preparation	7
9.2	Fill Materials	7
9.3	Fill Placement and Compaction	7
9.4	Quality Control	8
10.0	PAVEMENTS	8
10.1	Flexible Pavement	9
10.2	Rigid Pavement	10
11.0	CONSULTATION	11
	FIGURE 1	
	APPENDIX A	

REPORT OF
GEOTECHNICAL INVESTIGATION
ST. TAMMANY PARISH SCHOOL BOARD
HENRY MAYFIELD ELEMENTARY SCHOOL
SLIDELL (ST. TAMMANY PARISH), LOUISIANA

1.0 INTRODUCTION AND LIMITATIONS

This report contains the results of a geotechnical investigation performed for proposed Henry Mayfield Elementary School in Slidell, Louisiana. The investigation was performed in accordance with Ardaman and Associates (AAI) approved proposal dated 7 August 2008.

The analyses and recommendations presented in this report are based on the provided project information and the results of the investigation. While it is not likely that conditions will differ greatly from those observed in the soil borings, it is always possible that variations can occur away from the borehole locations. If it becomes apparent during construction that subsurface conditions differing significantly from those observed in our borings are being encountered, this office should be notified at once so their effects can be determined and any remedial measures necessary can be prescribed. Also, should the nature of the project change, the recommendations provided in this report may have to be re-evaluated.

This report has been prepared for the exclusive use of the STPSB and their consultants for the purpose of constructing the proposed project features as generally described in this report. The recommendations provided in this report are site specific and are not intended for use at any other site or for any other facility. This report provides recommendations for design and construction and should not be used as construction specifications.

2.0 SCOPE

This investigation included drilling eleven (11) soil borings to obtain samples of the various subsoils and to determine subsurface conditions and stratification. Soil mechanics laboratory tests were used to evaluate the physical properties of the subsoils. Engineering analyses based on the soil borings and laboratory test results were made to determine recommendations regarding allowable soil bearing values, estimates of settlement, site preparation, rigid and flexible pavement design recommendations, and general construction procedures.

3.0 FIELD AND LABORATORY PROCEDURES

Detailed descriptions of the field and laboratory procedures used for this project are contained in Appendix A. Details of the soil conditions encountered at the borehole locations are provided on the individual logs in the appendix.

For this project, eleven (11) soil borings were made. Four (4) of the borings were completed to the 50 foot depth and seven (7) borings were completed to the 20 foot depth below the existing ground surface.

The locations of the soil borings are shown on Figure 1 and were determined by a geotechnical engineer. The borings were located in the field by an AAI field technician and our drill crew. Site clearing was required for access to the boring locations as the site is currently heavily wooded.

Soil mechanics laboratory tests were performed on the samples obtained from the undisturbed soil borings. The results of the laboratory tests are summarized on the boring logs in Appendix A.

4.0 SITE CONDITIONS

In a geotechnical investigation of this nature, various aspects of site conditions must be taken into consideration. Subsurface conditions (soil and groundwater) have been investigated by performing soil borings. An understanding of site topography and the geology of the area are based upon observations made during the field investigation program and our experience in the general area. The following paragraphs provide a discussion of these various site conditions.

4.1 Location and Topography

The proposed project features will be constructed in vacant property located along U.S. Highway 190 in Slidell, Louisiana. The site for this project is heavily wooded. Site clearing was required for access to the boring locations.

4.2 Geology

Geologically, the deposits of Pleistocene Age appear to underlie the site. Pleistocene Age soils appear to be present from the ground surface to the deepest boring's termination depth of 50 feet.

4.3 Soil Conditions

Medium stiff to very stiff tan and gray sandy clay, silty clay, and clay with organic matter appears from the ground surface to the approximate 6 to 8 foot depths. Medium dense to dense tan and gray silty sand and sand follows to the approximate 12 to 26 foot depths. Medium stiff to very stiff tan and gray clay, silty clay, and sandy clay is present below the sand layers to the borings' deepest termination depth of 50 feet. A generalized subsoil profile is included in Appendix A.

4.4 Ground Water

The soil borings were initially dry-augured in order to locate groundwater and observe its short-term rise characteristics. Free water was first encountered at the approximate 7 to 14 foot depths. Where measured, the ground water level rose to the approximate 2 to 4 foot depths.

The presence and depth to groundwater can fluctuate with rainfall or other seasonal variations. The depth to groundwater should be verified prior to beginning any construction operations affected by groundwater.

5.0 PROJECT CONSIDERATIONS

This section provides information regarding the project that is pertinent to the geotechnical investigation. This information includes a description of the project as provided to this office and recommendations regarding foundation support for the proposed structure.

5.1 Furnished Information

Ms. Cameron Tipton with the St. Tammany Parish School Board provided information for this project. We understand the proposed project will consist of a new elementary school campus in Slidell, LA. The new campus will consist of multiple, interconnected, one story buildings with parking and driveway areas. Maximum loads were furnished as 50 kips for columns and 5 kips per foot for walls. We understand up to 6 feet of fill will be placed to raise the site above present grade. Site clearing for construction will be required.

5.2 Foundation Recommendations

The proposed project features may be supported on shallow foundations provided the settlement estimates in this report can be tolerated and the allowable bearing values can be adhered to. Deep foundation support for the structures should be used as an alternative if the allowable bearing values or settlements provided in this report are not tolerable. Deep foundation recommendations can be provided as a supplement to this report if needed.

The footings and foundations for the structures will be constructed in fill. Long term performance of the foundations will be dependent on the success of the fill placement, compaction, and monitoring.

The results of our laboratory tests indicate the near surface soils at the site appear to have a low potential for swelling. Additional research should be done by the project designers to determine if surrounding or nearby structures have experienced any shrink/swell related movements.

6.0 FILL PLACEMENT EFFECTS

6.1 Fill Settlement

Placement of fill will cause consolidation of the underlying soil deposits and settlement of the ground surface. We have calculated the estimated long-term settlement of the ground surface due to a maximum of 6 feet of fill placed across the site. The results of our analyses are provided on the following table.

Fill Height (feet)	Estimated Center Settlement (inches)
6	5 to 6

Our settlement estimates are based on a unit weight of 110 pcf for the fill material and an assumed fill area of approximately 500 feet by 1,000 feet in plan dimensions.

6.2 Time Rate

We estimate that approximately 50% of the ultimate settlement will occur within 1 month of fill placement and approximately 90% of the estimated ultimate settlement will occur within a time period of 3 months. It should be noted that time rate estimates are difficult to predict. Actual values may vary 20 to 30% from our predicted values.

6.3 Monitoring

A main component for determination of the long term success of the foundations will be monitoring the settlement of the ground surface during and after fill placement. We recommend a series of settlement plates be installed within the area to be filled. The settlement plates should consist of a metal or PVC riser pipe welded to a metal base plate.

The settlement plates should be surveyed prior to fill placement and then immediately after fill is placed. Subsequent readings of the settlement plates should be taken once every week for the first month and once every 2 weeks thereafter. Care should be taken during fill placement to avoid damaging or hitting the settlement plates. The survey results should be provided to AAI after each reading for review and interpretation.

7.0 SHALLOW FOUNDATIONS

Shallow foundations are commonly used where subsurface conditions permit the foundations to be adequately supported without failure of the bearing strata in shear strength or excessive displacement. Shallow foundations may be used for the proposed structures provided that the calculated settlements are tolerable, the fill program is monitored, and the provided bearing capacities are not exceeded.

7.1 Bearing Capacity

Footings are anticipated to be placed within compacted, structural, fill. The footings should be placed to bear at a maximum depth of two (2) feet below final grade. Footings so placed may be designed for net allowable soil bearing values of 1,200 psf for wall or continuous footings and 1,500 psf for isolated square footings.

The allowable bearing values contain an estimated factor of safety of 3 against failure and are net values in which the weights of backfill and concrete below grade have already been considered. Fill placed beneath structures should be placed and compacted in accordance with the recommendations of this report.

7.2 Settlements

Settlement estimates were made for footings with a maximum bearing intensity equal to 100% of the allowable bearing values applied to them. The results of our analyses indicate long-term settlements on the order of ½ to 1 inch should be anticipated for shallow footings.

Our settlement analyses assume a maximum width of 3 feet for continuous footings and 8 feet for square isolated footings. Adjacent grade supported foundations should be spaced apart at least two footing widths to minimize overlapping stresses which can result in additional settlement.

Settlement analyses were also made for a proposed slab on grade. The results of our analyses are provided on the following table.

Settlement – Slab on Grade (Maximum Net Bearing Pressure = 200 psf)	
Slab Size (feet)	**Estimated Center Settlement (inches)**
50 by 50	½ to ¾

10.1 Flexible Pavement

The subgrade should first be prepared in accordance with Section 9.0 of this report. The base course should be constructed over the prepared subgrade. Base course material should consist of crushed stone aggregate.

Crushed stone aggregate should be compacted to a relative density of 75%, or higher, according to the ASTM D 4253 and ASTM D 4254, or to a minimum dry density of 95 percent of its maximum dry density as determined by the Modified Proctor compaction test (ASTM D 1557).

The stone should overlay a geotextile fabric for separation and to prevent pumping of finer grain soils. The geotextile should be a nonwoven fabric with an apparent opening size (AOS) smaller than a U.S. No. 70 sieve.

Based on the assumed traffic loading conditions, the following thicknesses are recommended for flexible pavement components. The recommended thicknesses are based on a subgrade CBR of 4.

Recommended Flexible Paving Thicknesses (Inches)		
Item	**Parking Areas**	**Roadways**
Asphalt Pavement Course	4	5
Base Course	8	12

We recommend the asphalt courses be placed as late as possible in the project so that the effects of settlement can be reduced. Proper drainage during and after construction is essential to the success of flexible asphaltic pavement systems.

Flexible pavements are susceptible to failures due to poor surface and subsurface drainage. Asphalt pavement generally requires surface sealing with a thin (½ inch) hot mix asphaltic concrete or an asphalt slurry seal at a 4 to 5 year interval to maintain a good pavement system because the local climate tends to weaken and oxidize the surface.

The provided settlement values may be reduced by 15% if a rigid foundation is used. The floor slab settlement estimates should be considered additive to the estimates provided for continuous or spread footings. Additionally, settlement at the edges and midpoints of the sides of a flexible slab may be taken as one-quarter to one-half of the settlement provided above, respectively. Settlement estimates due to structural loads in this section do not include settlement from fill.

7.3 Inspection and Protection of the Bearing Surface

Inspection of footing excavations by a qualified geotechnical engineer or his representative should be performed prior to steel placement to ensure that the proper bearing surface is present. The soils that form the bearing stratum will be clays and can undergo severe loss of strength when wetted. Traffic in the foundation excavations should be limited.

Drainage should be provided away from the footings both during and after construction. Footing excavations should not be made during periods of inclement weather. Footings should not be allowed to stay open more than one day before concrete is placed. In the case of possible inclement weather, it is recommended that a "mudmat" consisting of lean concrete be placed to protect the bearing surface until the structural concrete is placed.

8.0 FLOOR SLABS

Structural loads carried by walls and columns will be transmitted to the supporting strata by shallow foundations. Common types of slab-on-grades are reinforced or post- tensioned slabs with or without interior ribs. We recommend either of these types of slabs be used for this project. Standard construction practice of using a vapor barrier and capillary breaker should be included in the design of the slab. A registered and qualified civil/structural engineer should design the ribbed slab.

8.1 Modulus of Subgrade Reaction

Slabs should be poured integrally with footings and grade beams to minimize the potential for differential settlement. Assuming a minimum of 6 inches of select fill is placed beneath the floor slab, we estimate a modulus of subgrade reaction (k value) of 150 pci may be used.

9.0 EARTHWORK CONSIDERATIONS

At a minimum, the site will require earthwork associated with grading and preparation for the new structures and pavements. The following paragraphs provide pertinent recommendations associated with potential earthwork activities.

9.1 Site Preparation

Significant site preparation problems will develop unless good drainage is provided throughout the project duration. In order to prepare the building and pavement areas for fill or subgrade, the site should first be stripped of all vegetation, organic matter, etc.

Subsequent to the removal of these undesirable materials, the building areas should be proof-rolled. Proof-rolling should be performed using heavy wheeled vehicles, such as loaded dump trucks. The proof-rolling should be observed by a qualified geotechnical engineer or technician to detect pumping or yielding areas or other undesirable subgrade.

Such conditions, if present, may require undercutting and replacement with more competent fill. These recommended procedures are intended to serve as an aid to the construction of site fill and not as a method of providing "all weather" construction conditions.

Proper site drainage should be maintained during and after construction. Providing drainage during the construction process will facilitate construction by reducing the potential for compaction problems. Maintaining the drainage after construction will improve the life of the structure by avoiding water softening of the foundation soils.

9.2 Fill Materials

Subsequent to the site preparation activities, the area should be brought to grade using a clean, select fill material free from debris or organic matter. A cohesionless soil described as clean sand with less than 10% passing the No. 200 Sieve should be used as fill. Alternately, cohesive fill materials may be used and should consist of silty or sandy clay with a plasticity index of 10 to 22 and a liquid limit of less than 40. The material should be classified as CL in accordance with the United Soil Classification System (USCS).

9.3 Fill Placement and Compaction

Cohensionless fill should be placed in 10 to 12 inch loose lifts. This fill should be compacted to a minimum dry density of 95% of its maximum as determined by the Modified Proctor compaction test (ASTM D 1557).

Cohesive fill (CL) should be placed in 6 to 8 inch loose lifts and compacted to a dry density at least equal to 95% of its maximum as determined by the Standard Proctor compaction test (ASTM D 698) before another lift is added. This specification can be lowered to 90% in non-structural (landscape, walkway) areas. Light scarification of each lift is recommended in order to provide proper bonding between lifts.

Compaction of cohesive fill on the existing subgrade will be difficult during w
Proper drainage should be provided in order to facilitate fill placement during b
wet weather constructions.

9.4 Quality Control

The use of the correct fill materials and the proper placement and compaction are
any earthwork where subsequent construction of driveways, parking areas, or str
planned. Construction monitoring by a qualified geotechnical engineer or tech
recommended to document that proper fill construction has been accomplished.

The responsibilities of the quality control representative generally include obser
excavations, proof rolling operations, documentation of material types, and fill pl
and compaction techniques. The QC engineer or technician should make sure the
proper material type, and is placed in the correct manner. Any deviation from th
should be reported to the design engineer. AAI can provide these services.

10.0 PAVEMENTS

Based upon our understanding of the proposed facility usage, we anticipate that the
areas will be for automobiles and lightly loaded trucks. Roadways and servicewa
require paving designed for access by delivery type trucks and waste collection tr
addition to the parking area traffic. Although no traffic loading information was fur
we have defined two usage categories for the paving design as follows:

Usage Category	Loading	Daily Passes
Parking Areas	Automobiles and Light Trucks (2 kip front & rear single axles)	Up to 500
Roadways/Serviceways	Parking Areas Plus: Delivery Type Vehicles (10 kip front single and 24 kip rear tandem axles)	Up to 10 (Delivery)
	Waste Collection Vehicles (12 kip front single and 38 kip rear tandem axles)	Up to 10 per month (Waste)

The following paragraphs provide recommendations for flexible (asphaltic) and ri
(Portland cement concrete) paving.

10.2 Rigid Pavement

Subgrade provisions are critical even though the concrete paving derives supporting capacity from the thickness, strength, and reinforcement of the concrete. Therefore, the recommendations provided in Section 9.0 should be followed for site preparation.

Upon completion of subgrade preparation, a six-inch (6) thick layer of crushed stone aggregate overlaying a geotextile fabric is recommended for base material.

The geotextile should be a nonwoven fabric with an apparent opening size (AOS) smaller than a U.S. No. 70 sieve. The stone should be compacted to a dry density at least equal to 95 percent of its maximum as determined by the Modified Proctor compaction test (ASTM D 1557).

The crushed stone should meet the following gradation.

Sieve Size	% Passing
1½ inch	100
1 inch	90 - 100
½ inch	25 - 60
No. 4	0 - 10
No. 200	0 - 1

Rigid paving designs have been performed based on a modulus of subgrade reaction (k) of 150 pci. Additionally, the design assumes 3,000 psi (minimum) concrete will be used. The design life of the pavement system is dependent upon periodic maintenance of the pavement. This maintenance includes, but is not limited to, cleaning and resealing joints, sealing cracks, and immediate repairs of damaged areas.

Based on design traffic information provided above, we recommend the following thicknesses for rigid concrete pavement.

Recommended Rigid Paving Thicknesses (Inches)		
Item	**Parking Areas**	**Roadways**
Rigid Concrete	5 inches	7 inches

The rigid concrete should conform similarly to the requirements of LA DOTD. Proper steel reinforcement (temperature and shrinkage) joint design and installation are essential to satisfactory pavement performance.

The concrete pavement may contain adequate wire mesh reinforcement for structural strength and to reduce temperature expansion affects. Adequate joints should be provided for expansion and contraction. The location and configuration of joints is important to reduce the concrete panel edge stress. In addition, adequate load transfer at all joints is necessary to reduce the concrete panel edge stress. Panel sizes should not exceed 15 feet in any direction.

The strength of the concrete should be verified prior to allowing any traffic to traverse the pavement. In addition, no construction traffic should be allowed on the light traffic pavement areas. If the strength of the concrete is less than specified, no traffic should be allowed on the pavement until the strength is reached. If the concrete does not attain its design strength after a period of 28 days, it should be removed and replaced with adequate concrete.

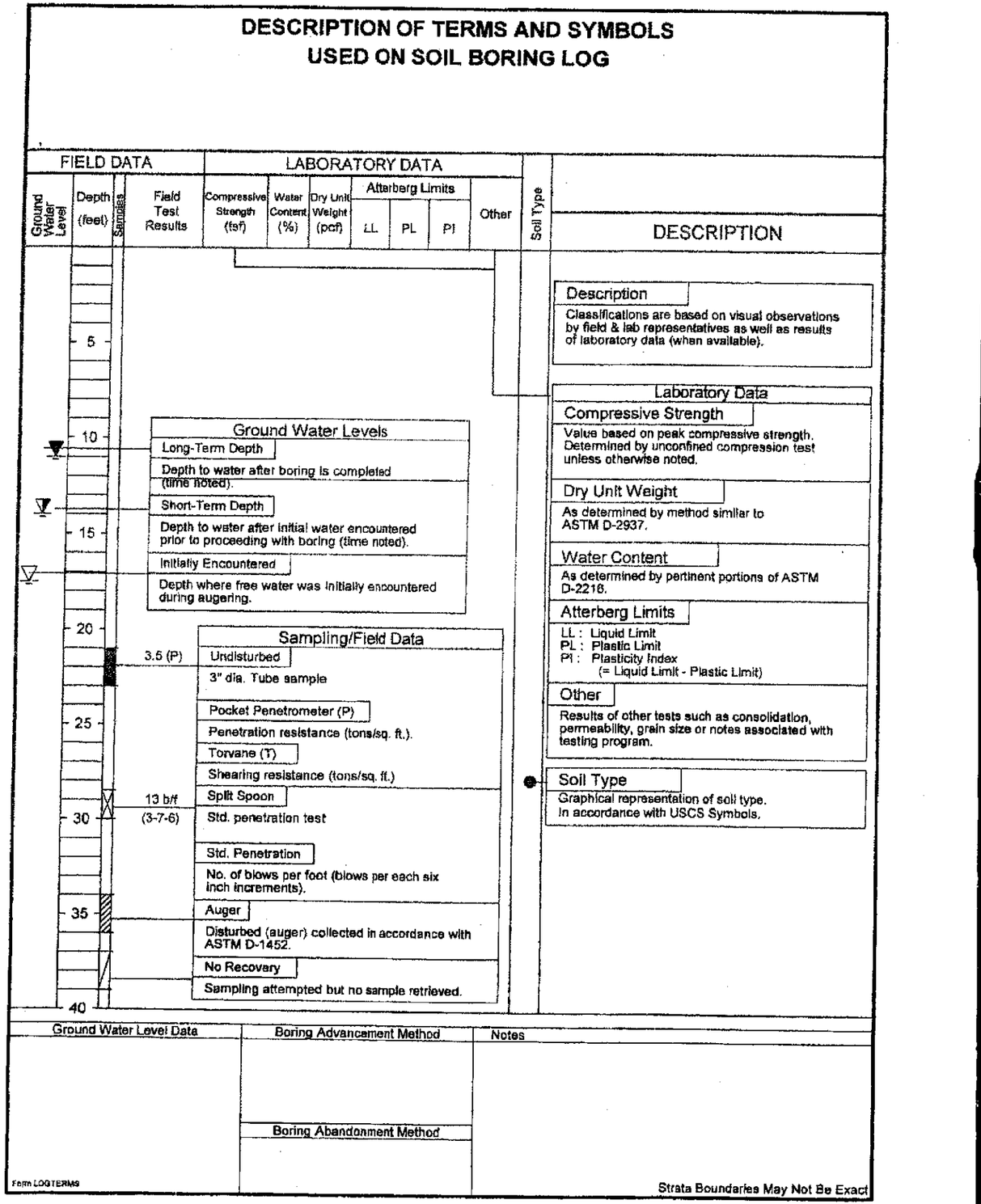
In addition to performing compressive strength tests, consideration should be given to performing flexural strength tests since design is based on flexural strength. The flexural strength tests consist of casting beams instead of cylinders. The beams may be tested using the third-point loading method (ASTM C 78) or center-point loading method (ASTM C 293).

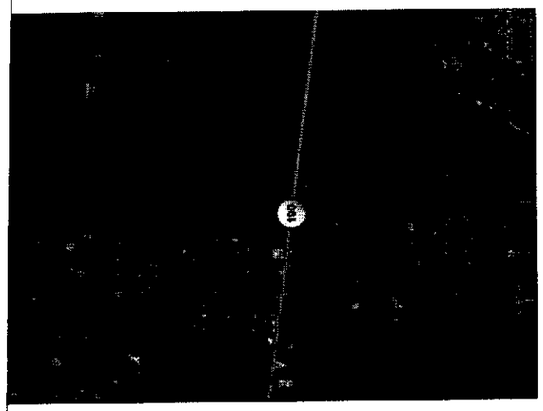
As with compressive strength testing, the flexural strength should be verified prior to allowing any traffic to traverse the pavement. If the concrete does not attain the design strength after a period of 28-days, it should be removed and replaced with adequate concrete.

11.0 CONSULTATION

Often during final design and /or construction, questions can arise which are not specifically covered in the report. They can normally be handled by a brief phone call or conference with the designers.

DESCRIPTION OF TERMS AND SYMBOLS USED ON SOIL BORING LOG





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NOT TO S

REFERENCE:
SITE IMAGE BY GOOG

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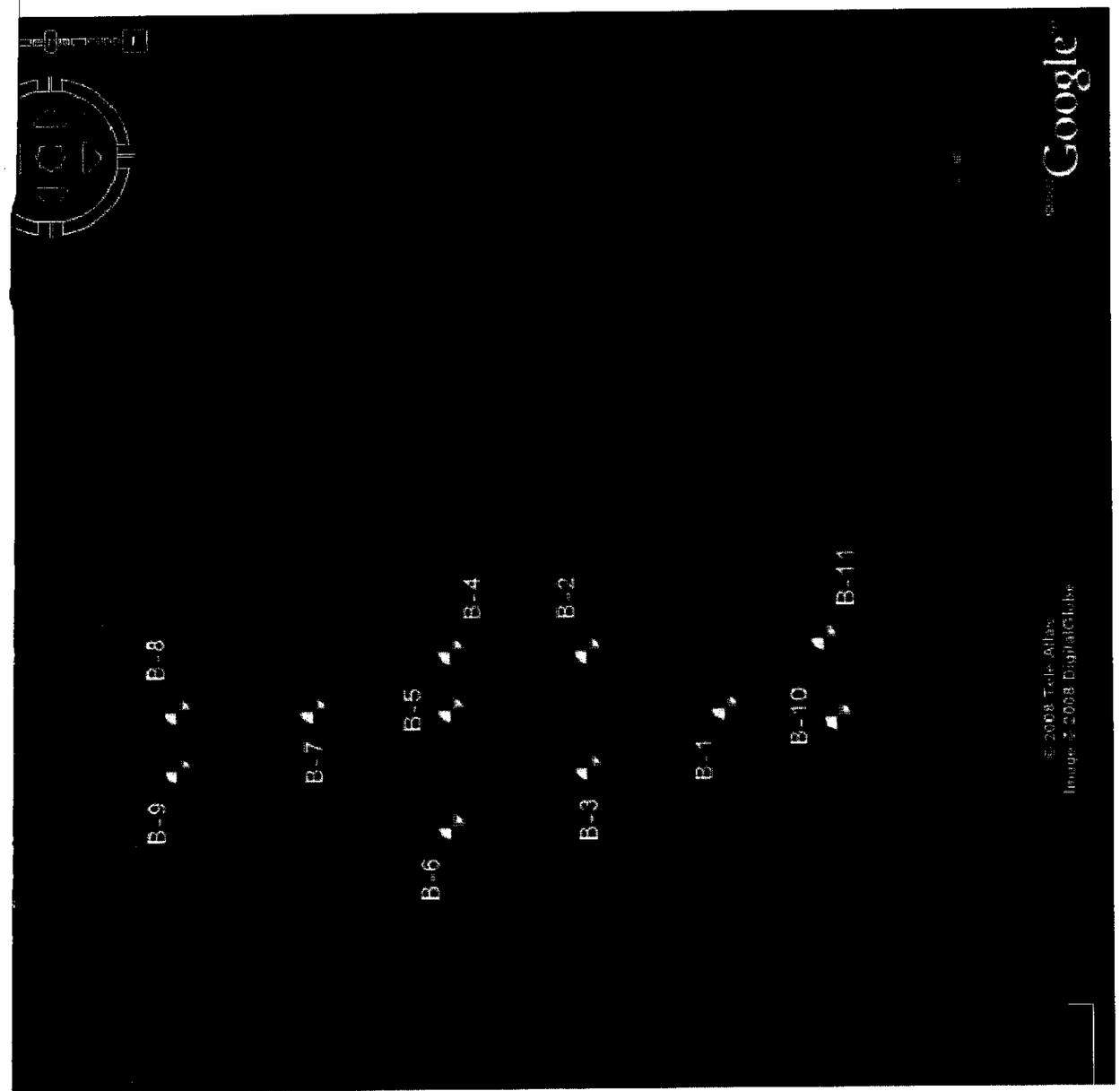
Project



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APPENDIX A

FIELD AND LABORATORY PROCEDURES

The following paragraphs describe the field and laboratory procedures used for this investigation. Soil boring logs are included with this appendix. The boring logs provide the field and laboratory data collected.

A.1 FIELD EXPLORATION

Eleven (11) soil borings were made for this project to investigate subsurface conditions. The borings were drilled on 4 through 7 November 2008. The approximate locations of the borings at the project site were located in the field by an AAI technician and the drill crew. Site clearing with a bulldozer was required for access to the boring locations.

A.1.1 Drilling Methods

The borings were drilled with ATV-mounted, rotary-type drilling equipment. The soil boring was advanced using a nominal four-inch diameter short flight auger. This technique allowed the proper borehole advancement to secure the appropriate samples (see "Sampling Procedures") and allowed the observation of the presence of free water in the borehole. Upon completion of the borings, the boreholes were backfilled or grouted full depth in accordance with Louisiana regulations.

A.1.2 Sampling Procedures

Soil samples were obtained continuously within the upper 10 feet. Continuous sampling was performed to provide detailed information for near surface stratigraphy. Below the 10 foot depth, the samples were obtained at three to five feet on center.

In these cohesive and semi-cohesive soils, relatively undisturbed samples were secured using a three-inch diameter, thin-wall steel tube sampler. In this sampling procedure, the borehole is advanced to the desired level, and the tube is lowered to the bottom of the boring. It is then pushed about two feet into the undisturbed soil in one continuous stroke. The sample and tube are retrieved from the borehole and detached from the drill string.

The sample is extruded by a hydraulic piston onto a rigid sample catcher to minimize disturbance. The sample is then visually classified. The classification includes description of soil color, strength estimates, identification of structural conditions (layering, seams, etc.) and variations (organics, oxide inclusions, etc.). A pocket penetrometer strength test is performed. Any disturbed portions are discarded, and the sample is sealed to minimize disturbance and moisture loss during transportation to the laboratory.

In the less cohesive materials, standard penetration tests were performed. These tests provide a measure of the in situ characteristics of the soil and secure a disturbed sample. In this test, a 2 inch OD, 1.37 ID, heavy-walled "split spoon" sampler is driven into the undisturbed soil at the bottom of the borehole with a drop hammer weighing 140 pounds and having a stroke of 30 inches. It is first seated 6 inches, then driven an additional two, six-inch increments. The "Penetration Resistance" is the number of such blows required to drive the spoon the last 12 inches. It is recorded on the boring log in the following manner:

24 b/f
(7-9-15)

where the figures in parenthesis indicate the number of blows required for each 6 inch increment.

A.2 LABORATORY PROCEDURES

Certain samples from the various strata were tested in the laboratory to determine their pertinent physical characteristics. The samples and types of tests performed were selected by a geotechnical engineer to develop information necessary for appropriate analyses. The testing program, conducted in general accordance with ASTM methods, is described below.

A.2.1 Strength Tests

The strength characteristics of the various soil strata are important for geotechnical engineering analyses. Thirty-nine (39) unconfined compression tests and one (1) one point, unconsolidated, undrained, triaxial compression test were performed to develop this data. The testing procedures also include determination of the moisture content and wet and dry density of the sample.

The results of the compression tests are tabulated in the laboratory data portion of the soil boring log under the column heading "Compressive Strength". The moisture content and dry density data are tabulated in the subsequent two columns within the laboratory data portion of the logs.

A.2.2 Classification Tests

In order to classify the soils more definitely than can be done by field methods, eighteen (18 Atterberg Limits determinations, twenty-nine (29) separate moisture content determinations, and fou (4) percent passing the No. 200 sieve were performed. The results of these tests are provided on th soil boring logs.

Henry Mayfield Elementary School
St. Tammany Parish School Board
Slidell (St. Tammany Parish), LA

LOG OF SOIL BORING B-01

Ardaman & Associates, Inc.

Sheet 1 of 1

Baton Rouge Geotechnical Laboratory
AASHTO Accredited Laboratory , LELAP Certificate No. 02052,
USACE Validated

File: 08-L3235
Date: 11/04/08
Logged by: J. Garner
Driller: D. Anthony
Rig: Ardco K-1000

St. Tammany Parish School Board
Covington, LA

Location: See Boring Plan

Surface Elevation: N/A (ft., NAVD)

FIELD DATA				LABORATORY DATA									
Ground Water Level	Depth (feet)	Samples	Field Test Results	Compressive Strength (tsf)	Water Content (%)	Wet Unit Weight (pcf)	Atterberg Limits LL	Atterberg Limits PL	Atterberg Limits PI	Percent Passing #200 Sieve	Other	Soil Type	Description
▽			1.5 (P) 4.0 (P)										Stiff to very stiff tan and brown SILTY CLAY (CL) w/ organic matter and trace sand
			No (P)										
	5		4.0 (P) 4.5 (P)		12		25	15	10				
▽			1.5 (P) 3.0 (P)	0.85	15	128	26	15	11				Medium stiff tan SILTY CLAY (CL) w/ trace sand
			17 b/f 6-5-12										Medium dense gray SILTY SAND (SM)
	10												
			20 b/f 7-9-11		23					26			
	15												
			1.5 (P) 1.0 (P)	0.73	22	124							Medium stiff gray SANDY CLAY (CL)
	20												Boring completed at 20 ft.
	25												
	30												
	35												
	40												
	45												
	50												

Ground Water Level Data

▽ Free water first encountered

▽ Water level after 15 mins.

Boring Advancement Method

4" Nom. Dia. Short Flight Auger:
0 to 20 ft.

Boring Abandonment Method

Borehole backfilled with soil upon completion

Notes

Strata Boundaries May Not Be Exact

ARD LOG01.01R 083235.GPJ LOG01R.GDT 12/03/08

Henry Mayfield Elementary School
St. Tammany Parish School Board
Slidell (St. Tammany Parish), LA

LOG OF SOIL BORING B-02

Ardaman & Associates, Inc.

Sheet 1 of 1

Baton Rouge Geotechnical Laboratory
AASHTO Accredited Laboratory , LELAP Certificate No. 02052,
USACE Validated

File: 08-L3235
Date: 11/04/08
Logged by: J. Garner
Driller: D. Anthony
Rig: Ardco K-1000

St. Tammany Parish School Board
Covington, LA

Location: See Boring Plan

Surface Elevation: N/A (ft., NAVD)

FIELD DATA				LABORATORY DATA								
Ground Water Level	Depth (feet)	Samples	Field Test Results	Compressive Strength (tsf)	Water Content (%)	Wet Unit Weight (pcf)	Atterberg Limits LL	Atterberg Limits PL	Atterberg Limits PI	Percent Passing #200 Sieve	Other	Soil Type	Description
▽			2.0 (P) 4.5 (P) 4.0 (P) 4.5 (P)	1.37	15	128	22	15	7				Stiff brown and gray VERY SILTY CLAY (CL-ML) w/ organic matter
	5		1.5 (P) 1.5 (P) 2.0 (P) 1.5 (P)	1.13	14	130							Stiff tan SILTY CLAY (CL)
▽	10		16 b/f 3-7-9		21					24			Medium dense gray SILTY SAND (SM)
	15		20 b/f 6-9-11		25								
	20		20 b/f 10-7-13		26								Boring completed at 20 ft.
	25												
	30												
	35												
	40												
	45												
	50												

Ground Water Level Data

▽ Free water first encountered

▽ Water level after 15 mins.

Boring Advancement Method

4" Nom. Dia. Short Flight Auger:
0 to 20 ft.

Boring Abandonment Method

Borehole backfilled with soil upon completion

Notes

Strata Boundaries May Not Be Exact

ARD LOG01 01R 083235.GPJ LOG01R.GDT 12/03/08

Henry Mayfield Elementary School
St. Tammany Parish School Board
Slidell (St. Tammany Parish), LA

LOG OF SOIL BORING B-03

Ardaman & Associates, Inc.

Sheet 1 of 1

Baton Rouge Geotechnical Laboratory
AASHTO Accredited Laboratory , LELAP Certificate No. 02052,
USACE Validated

File: 08-L3235
Date: 11/06/08
Logged by: J. Garner
Driller: D. Anthony
Rig: Ardco K-1000

St. Tammany Parish School Board
Covington, LA

Location: See Boring Plan

Surface Elevation: N/A (ft., NAVD)

FIELD DATA				LABORATORY DATA									
Ground Water Level	Depth (feet)	Samples	Field Test Results	Compressive Strength (tsf)	Water Content (%)	Wet Unit Weight (pcf)	Atterberg Limits LL	Atterberg Limits PL	Atterberg Limits PI	Percent Passing #200 Sieve	Other	Soil Type	Description
▽			No (P)										Medium stiff to stiff tan and brown SILTY CLAY (CL) w/ sand and organic matter
			No (P)		16		28	15	13				
	5		1.5 (P)										
			1.5 (P)	0.77	18	129							
			16 b/f 4-7-9		23								Medium dense gray SAND (SP)
▽	10		17 b/f 6-4-13		24								
			2.0 (P)										Stiff tan and gray SILTY CLAY (CL)
	15		1.5 (P)	1.05	24	126							
			23 b/f 8-9-14										Medium dense gray SAND (SP)
	20												
			22 b/f 10-12-10		24								
	25												
			22 b/f 10-7-15										
	30												
			22 b/f 4-7-15		34								
	35												
			2.0 (P)										Medium stiff gray SILTY CLAY (CL)
	40		2.0 (P)	0.58	43	112							
			1.5 (P)										
	45		1.5 (P)										
			1.5 (P)										
	50		2.5 (P)	0.81	31	113							

Boring completed at 50 ft.

Ground Water Level Data

▽ Free water first encountered

▽ Water level after 15 mins.

Boring Advancement Method

4" Nom. Dia. Short Flight Auger:
0 to 15 ft.
4" Dia. Rotary Wash:
15 to 50 ft.

Boring Abandonment Method

Borehole grouted with cement/ bentonite upon completion

Notes

Strata Boundaries May Not Be Exact

ARD LOG01 01R 083235.GPJ LOG01R.GDT 12/03/08

Henry Mayfield Elementary School
St. Tammany Parish School Board
Slidell (St. Tammany Parish), LA

St. Tammany Parish School Board
Covington, LA

LOG OF SOIL BORING B-04

Ardaman & Associates, Inc.

Sheet 1 of 1

Baton Rouge Geotechnical Laboratory
AASHTO Accredited Laboratory, LELAP Certificate No. 02052,
USACE Validated

File: 08-L3235
Date: 11/04/08
Logged by: J. Garner
Driller: D. Anthony
Rig: Ardco K-1000

Location: See Boring Plan

Surface Elevation: N/A (ft., NAVD)

FIELD DATA				LABORATORY DATA									
Ground Water Level	Depth (feet)	Samples	Field Test Results	Compressive Strength (tsf)	Water Content (%)	Wet Unit Weight (pcf)	Atterberg Limits LL	Atterberg Limits PL	Atterberg Limits PI	Percent Passing #200 Sieve	Other	Soil Type	Description
▽			No (P)										Stiff tan and gray SANDY CLAY (CL) w/ organic matter
			2.0 (P)										
			3.5 (P)	1.00	14	123	29	15	14				
	5		3.0 (P)										
			4.0 (P)	1.16	13	127							
			2.5 (P)	2.72	22	131				10			Very stiff tan SANDY CLAY (CL)
▽			2.5 (P)	t=2.8									
			16 b/f		19								Medium dense tan SAND (SP)
	10		3-6-10										
			1.0 (P)										Medium stiff gray SANDY CLAY (CL)
			1.0 (P)	0.50	25	125							
	15												
													Stiff to very stiff gray SANDY CLAY (CL)
			4.5 (P)										
			2.0 (P)										
	20												Boring completed at 20 ft.
	25												
	30												
	35												
	40												
	45												
	50												

Ground Water Level Data

▽ Free water first encountered

▽ Water level after 15 mins.

Boring Advancement Method

4" Nom. Dia. Short Flight Auger: 0 to 20 ft.

Boring Abandonment Method

Borehole backfilled with soil upon completion

Notes

t: Unconsolidated, Undrained Triaxial Compression Test Pressure in psi

Strata Boundaries May Not Be Exact

ARD LOG01 01R 083235.GPJ LOG01R.GDT 12/03/08

Henry Mayfield Elementary School
St. Tammany Parish School Board
Slidell (St. Tammany Parish), LA

LOG OF SOIL BORING B-05

Ardaman & Associates, Inc.

Sheet 1 of 1

Baton Rouge Geotechnical Laboratory
AASHTO Accredited Laboratory, LELAP Certificate No. 02052,
USACE Validated

File: 08-L3235
Date: 11/04/08
Logged by: J. Garner
Driller: D. Anthony
Rig: Ardco K-1000

St. Tammany Parish School Board
Covington, LA

Location: See Boring Plan

Surface Elevation: N/A (ft., NAVD)

FIELD DATA				LABORATORY DATA									
Ground Water Level	Depth (feet)	Samples	Field Test Results	Compressive Strength (tsf)	Water Content (%)	Wet Unit Weight (pcf)	Atterberg Limits LL	Atterberg Limits PL	Atterberg Limits PI	Percent Passing #200 Sieve	Other	Soil Type	Description
▼			3.5 (P) 2.0 (P)		20		35	18	17				Stiff to very stiff tan and gray SILTY CLAY (CL) w/ organic matter
	5		1.0 (P) 2.0 (P)	0.52	18	121							Medium stiff to stiff tan and gray SILTY CLAY (CL)
▽			3.0 (P) 3.0 (P)	1.01	18	129	29	16	13				
	10		18 b/f 5-7-11		21								Medium dense gray SILTY SAND (SM)
	15		19 b/f 7-6-13		19								
	20		22 b/f 6-10-12		20								Boring completed at 20 ft.
	25												
	30												
	35												
	40												
	45												
	50												

Ground Water Level Data	Boring Advancement Method	Notes
▽ Free water first encountered ▼ Water level after 15 mins.	4" Nom. Dia. Short Flight Auger: 0 to 20 ft.	
	Boring Abandonment Method Borehole backfilled with soil upon completion	Strata Boundaries May Not Be Exact

ARD LOG01 01R 083235.GPJ LOG01R.GDT 12/03/08

Henry Mayfield Elementary School
St. Tammany Parish School Board
Slidell (St. Tammany Parish), LA

St. Tammany Parish School Board
Covington, LA

LOG OF SOIL BORING B-06

Ardaman & Associates, Inc.

Sheet 1 of 1

Baton Rouge Geotechnical Laboratory
AASHTO Accredited Laboratory, LELAP Certificate No. 02052,
USACE Validated

File: 08-L3235
Date: 11/04/08
Logged by: J. Garner
Driller: D. Anthony
Rig: Ardco K-1000

Location: See Boring Plan

Surface Elevation: N/A (ft., NAVD)

FIELD DATA				LABORATORY DATA								
Ground Water Level	Depth (feet)	Samples	Field Test Results	Compressive Strength (tsf)	Water Content (%)	Wet Unit Weight (pcf)	Atterberg Limits LL	Atterberg Limits PL	Atterberg Limits PI	Percent Passing #200 Sieve	Other	Soil Type	Description
			2.0 (P) 3.0 (P)										Stiff tan and gray SANDY CLAY (CL) w/ organic matter
▽			2.0 (P) 3.5 (P)	1.20	13	129	23	17	6				
	5		3.5 (P) 2.0 (P)	1.10	15	128	26	17	9				
			1.5 (P) 3.0 (P)	0.67	14	123							Medium stiff tan and brown SANDY CLAY (CL)
			21 b/f 6-9-12		17								Medium dense to dense gray SILTY SAND (SM)
	10												
▽			21 b/f 7-10-11										
	15												
			30 b/f 10-9-21		23								
	20												Boring completed at 20 ft.
	25												
	30												
	35												
	40												
	45												
	50												

Ground Water Level Data

▽ Free water first encountered

▽ Water level after 15 mins.

Boring Advancement Method

4" Nom. Dia. Short Flight Auger:
0 to 20 ft.

Boring Abandonment Method

Borehole backfilled with soil upon completion

Notes

Strata Boundaries May Not Be Exact

ARD LOG01 01R 083235.GPJ LOG01R.GDT 12/03/08

Henry Mayfield Elementary School
St. Tammany Parish School Board
Slidell (St. Tammany Parish), LA

LOG OF SOIL BORING B-10

Ardaman & Associates, Inc.

Sheet 1 of 1

Baton Rouge Geotechnical Laboratory
AASHTO Accredited Laboratory , LELAP Certificate No. 02052,
USACE Validated

File: 08-L3235
Date: 11/07/08
Logged by: J. Garner
Driller: D. Anthony
Rig: Ardco K-1000

St. Tammany Parish School Board
Covington, LA

Location: See Boring Plan

Surface Elevation: N/A (ft., NAVD)

Ground Water Level	Depth (feet)	Samples	Field Test Results	Compressive Strength (tsf)	Water Content (%)	Wet Unit Weight (pcf)	Atterberg Limits LL	Atterberg Limits PL	Atterberg Limits PI	Percent Passing #200 Sieve	Other	Soil Type	Description
▽			2.5 (P)										
			2.5 (P)										Very stiff tan and gray SANDY CLAY (CL) w/ organic matter
			4.5 (P)										
			4.5 (P)	2.12	14	129	26	14	12				
	5		1.5 (P)										
			2.0 (P)	0.90	15	128	19	14	5				Medium stiff tan SANDY CLAY (CL)
			1.5 (P)										
			1.5 (P)	0.69	15	127							
▽			16 b/f										
	10		5-7-9		26								Medium dense gray SILTY SAND (SM) w/ clay layer
			18 b/f										
	15		6-8-10		21								
	20		No (P)										
			29 b/f										
	25		10-12-17		24								
			1.5 (P)										Medium stiff gray SILTY CLAY (CL)
	30		1.5 (P)	0.36	38	118							
			1.5 (P)										
	35		1.5 (P)										
			1.5 (P)										
	40		1.5 (P)	0.60	40	126							
			1.5 (P)										
	45		1.5 (P)										
			1.5 (P)										
	50		1.5 (P)	0.98	31	122							

Boring completed at 50 ft

Ground Water Level Data

▽ Free water first encountered

▼ Water level after 15 mins.

Boring Advancement Method

4" Nom. Dia. Short Flight Auger:
0 to 15 ft.
4" Dia. Rotary Wash:
15 to 50 ft.

Boring Abandonment Method

Borehole grouted with cement/ bentonite upon completion

Notes

Strata Boundaries May Not Be Exact

ARD LOG01 01R 083235.GPJ LOG01R.GDT 12/03/08

Henry Mayfield Elementary School
St. Tammany Parish School Board
Slidell (St. Tammany Parish), LA

LOG OF SOIL BORING B-07

Ardaman & Associates, Inc.

Sheet 1 of 1

Baton Rouge Geotechnical Laboratory
AASHTO Accredited Laboratory , LELAP Certificate No. 02052,
USACE Validated

File: 08-L3235
Date: 11/06/08
Logged by: J. Garner
Driller: D. Anthony
Rig: Ardco K-1000

St. Tammany Parish School Board
Covington, LA

Location: See Boring Plan

Surface Elevation: N/A (ft., NAVD)

Ground Water Level	Depth (feet)	Samples	Field Test Results	Compressive Strength (tsf)	Water Content (%)	Wet Unit Weight (pcf)	Atterberg Limits LL	Atterberg Limits PL	Atterberg Limits PI	Percent Passing #200 Sieve	Other	Soil Type	Description
			3.0 (P)										
▽			2.0 (P)										
			2.5 (P)	1.04	17	124	29	18	11				Medium stiff to stiff brown and gray SILTY CLAY (CL)
			2.0 (P)										
	5		4.0 (P)	1.00	16	124							
			1.5 (P)										
			2.5 (P)	0.62	18	129	25	18	7				
			2.5 (P)										
▽			15 b/f										
	10		4-5-10		27								Medium dense gray and tan SILTY SAND (SM)
			1.5 (P)										
	15		2.0 (P)	0.33	27	127	27	13	14				Soft to medium stiff gray and tan SILTY CLAY (CL)
			2.5 (P)										
	20		2.5 (P)										
			3.0 (P)										
	25		2.5 (P)	1.85	30	126							Stiff gray and tan SILTY CLAY (CL)
			3.0 (P)										
	30		3.0 (P)										Very stiff gray and tan SILTY CLAY (CL) w/ organic matter
			4.0 (P)										
	35		4.0 (P)	2.31	36	116							
			29 b/f										Medium dense gray SAND (SP) w/ shells
	40		6-9-20										
			3.0 (P)										
	45		1.5 (P)	0.65	50	107							Medium stiff gray and tan CLAY (CH) w/ trace silt and shells
			1.5 (P)										
	50		2.0 (P)										

Boring completed at 50 ft

Ground Water Level Data

▽ Free water first encountered

▼ Water level after 15 mins.

Boring Advancement Method

4" Nom. Dia. Short Flight Auger:
0 to 15 ft.
4" Dia. Rotary Wash:
15 to 50 ft.

Boring Abandonment Method

Borehole grouted with cement/ bentonite upon completion

Notes

Strata Boundaries May Not Be Exact

ARD LOG01 01R 083235.GPJ LOG01R.GDT 12/03/08

Henry Mayfield Elementary School
St. Tammany Parish School Board
Slidell (St. Tammany Parish), LA

LOG OF SOIL BORING B-08

Ardaman & Associates, Inc.

Sheet 1 of 1

Baton Rouge Geotechnical Laboratory
AASHTO Accredited Laboratory , LELAP Certificate No. 02052,
USACE Validated

File: 08-L3235
Date: 11/04/08
Logged by: J. Garner
Driller: D. Anthony
Rig: Ardco K-1000

St. Tammany Parish School Board
Covington, LA

Location: See Boring Plan

Surface Elevation: N/A (ft., NAVD)

Ground Water Level	Depth (feet)	Samples	Field Test Results	Compressive Strength (tsf)	Water Content (%)	Wet Unit Weight (pcf)	Atterberg Limits LL	Atterberg Limits PL	Atterberg Limits PI	Percent Passing #200 Sieve	Other	Soil Type	Description
▽			No (P)										Medium dense tan SILTY SAND (SM) w/ organic matter
			17 b/f 5-7-10		13					14			
	5		15 b/f 4-10-5		4								
▽			21 b/f 6-8-13		22								
	10		23 b/f 6-10-13										
	15		20 b/f 10-6-14		22								
			14 b/f 8-10-4		21								
	20												Boring completed at 20 ft.
	25												
	30												
	35												
	40												
	45												
	50												

Ground Water Level Data

▽ Free water first encountered

▼ Water level after 15 mins.

Boring Advancement Method

4" Nom. Dia. Short Flight Auger:
0 to 20 ft.

Boring Abandonment Method

Borehole backfilled with soil upon completion

Notes

Strata Boundaries May Not Be Exact

ARD LOG01 01R 083235.GPJ LOG01R.GDT 12/03/08

Henry Mayfield Elementary School
St. Tammany Parish School Board
Slidell (St. Tammany Parish), LA

LOG OF SOIL BORING B-09

Ardaman & Associates, Inc.

Sheet 1 of 1

Baton Rouge Geotechnical Laboratory
AASHTO Accredited Laboratory , LELAP Certificate No. 02052,
USACE Validated

File: 08-L3235
Date: 11/06/08
Logged by: J. Garner
Driller: D. Anthony
Rig: Ardco K-1000

St. Tammany Parish School Board
Covington, LA

Location: See Boring Plan

Surface Elevation: N/A (ft., NAVD)

Ground Water Level	Depth (feet)	Samples	Field Test Results	Compressive Strength (tsf)	Water Content (%)	Wet Unit Weight (pcf)	Atterberg Limits LL	Atterberg Limits PL	Atterberg Limits PI	Percent Passing #200 Sieve	Other	Soil Type	Description
▽			2.5 (P) 2.0 (P) 2.0 (P) 3.0 (P)	0.93	19	127	24	17	7				Soft to medium stiff tan and brown SILTY CLAY (CL) w/ organic matter
	5		2.0 (P) 2.0 (P)	0.48	20	119							
▽			3.0 (P) 1.5 (P) 1.5 (P)	1.34	19	129	31	16	15				Stiff gray SILTY CLAY (CL) w/ organic matter
	10		1.5 (P)										
	15		1.5 (P) 1.5 (P)	0.44	36	110							Soft gray CLAY (CH) w/ sand and organic matter
			4 b/f 2-2-2										
	20												Very stiff gray SILTY CLAY (CL)
			2.5 (P) 4.5+ (P)	2.42	23	125							
	25												
			4.0 (P) 4.0 (P)										
	30												Medium stiff to stiff gray SILTY CLAY (CL)
			1.5 (P) 4.5+ (P)	0.64	23	126							
	35												
			18 b/f 5-8-10										
	40												
			1.5 (P) 2.0 (P)	0.84	30	121							
	45												
			1.5 (P) 1.5 (P)										
	50												Boring completed at 50 ft.

Ground Water Level Data

▽ Free water first encountered

▼ Water level after 15 mins.

Boring Advancement Method

4" Nom. Dia. Short Flight Auger:
0 to 15 ft.
4" Dia. Rotary Wash:
15 to 50 ft.

Boring Abandonment Method

Borehole grouted with cement/ bentonite upon completion

Notes

Strata Boundaries May Not Be Exact

ARD LOG01 01R 083235.GPJ LOG01R.GDT 12/03/08

Henry Mayfield Elementary School
St. Tammany Parish School Board
Slidell (St. Tammany Parish), LA

LOG OF SOIL BORING B-11

Ardaman & Associates, Inc.

Sheet 1 of 1

Baton Rouge Geotechnical Laboratory
AASHTO Accredited Laboratory , LELAP Certificate No. 02052,
USACE Validated

File: 08-L3235
Date: 11/04/08
Logged by: J. Garner
Driller: D. Anthony
Rig: Ardco K-1000

St. Tammany Parish School Board
Covington, LA

Location: See Boring Plan

Surface Elevation: N/A (ft., NAVD)

Ground Water Level	Depth (feet)	Samples	Field Test Results	Compressive Strength (tsf)	Water Content (%)	Wet Unit Weight (pcf)	Atterberg Limits LL	Atterberg Limits PL	Atterberg Limits PI	Percent Passing #200 Sieve	Other	Soil Type	Description
▽			1.0 (P)										Medium stiff tan and brown SANDY CLAY (CL) w/ organic matter
			2.0 (P)										
			2.0 (P)		14		23	15	8				
			4.5 (P)										
	5		1.5 (P)	0.87	16	126							
			2.0 (P)										
▽			2.5 (P)	0.85	16	128	20	14	6				
			1.0 (P)										
					20								Medium dense gray SAND (SP)
	10												
					21								
	15												
													Soft gray SANDY CLAY (CL)
			1.5 (P)										
			1.0 (P)	0.45	22	129							
	20												Boring completed at 20 ft.
	25												
	30												
	35												
	40												
	45												
	50												

Ground Water Level Data

▽ Free water first encountered

▽ Water level after 15 mins.

Boring Advancement Method

4" Nom. Dia. Short Flight Auger:
0 to 20 ft.

Boring Abandonment Method

Borehole backfilled with soil upon completion

Notes

Strata Boundaries May Not Be Exact

ARD LOG01 01R 083235.GPJ LOG01R.GDT 12/03/08